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ABSTRACT

OFFERED PRIMARILY AS A POINT OF DEPARTURE FOR EDUCATORS WHO INTEND TO APPLY IPI IN AMERICAN SCHOOLS, THIS MANUAL OPENS WITH A HISTORY OF INDIVIDUALIZATION WHICH INCORPORATES A RATIONALE OF IPI BY ROBERT GLASER. SECTION II DISCUSSES EDUCATIONAL DIAGNOSIS, DIAGNOSTIC INSTRUMENTS AND MATERIALS; SECTION III IS DEVOTED TO PRESCRIPTION WRITING, WHILST THE FOURTH SECTION DEALS WITH TEACHING TECHNIQUES. THE ADMINISTRATION OF IPI, RESEARCH RELATED TO IPI, AND A PAPER ENTITLED 'THE ESSENTIAL ELEMENTS OF IPI' BY C. M. LINDVALL FORM THE TOPICS OF THE LAST THREE SECTIONS. A READING LIST FOR THE IPI INSTITUTE AND A BIBLIOGRAPHY ARE INCLUDED. (GO)

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INDIVIDUALLY PRESCRIBED INSTRUCTION

RESEARCH FOR BETTER SCHOOLS, INCORPORATED

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INDIVIDUALLY PRESCRIBED INSTRUCTION

A MANUAL FOR THE IPI INSTITUTE

June 27, 1966 - August 5, 1966

Learning Research and Development Center
University of Pittsburgh
Robert Glaser, Director

Prepared by the Staff of the IPI Project
John O. Bolvin, Director

compiled by
Robert G. Scanlon

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PREFACE

The School of Education of the University of Pittsburgh, in collaboration with the Learning Research and Development Center and the Baldwin-Whitehall School District, is offering this Institute to afford educators and researchers an opportunity to observe and study Individually Prescribed Instruction under schoolroom conditions.

John Bolvin and C. M. Lindvall[1] discuss the program of Individually Prescribed Instruction as one approach to the problem of individual differences and point out:

> A question that has been of continuing concern to teachers throughout most of the history of American education is that of how to meet the needs of the individual pupil within the context of school operations necessarily geared to masses of students. Despite the importance of this problem, it is still largely unsolved and the consensus of those who have given serious attention to it seems to be that its solution will require rather massive and long-range research and development efforts.
>
> Because of the potential contribution to educational practice that could result from any significant progress toward the development of procedures for providing for the many individual differences among students, the Learning Research and Development Center (LRDC) at the University of Pittsburgh is devoting major attention to this problem. A further basis for the decision to center attention on this need has been the feeling that it is this type of problem that the research and development center now being funded by the United States Office of Education has a unique opportunity to investigate. That is, it is a problem demanding a rather long-term commitment to the development of curriculum materials and instructional procedures and one which should involve the close

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[1] Bolvin, John and C. M. Lindvall, "Individually Prescribed Instruction: One Approach to the Problem of Individual Differences," Learning Research and Development Center, University of Pittsburgh, 1965.

> collaboration of practicing public school personnel, curriculum development specialists, subject-matter scholars, and a variety of types of behavioral scientists. Because of the nature and the magnitude of their findings, the new research and development centers are in a position to bring resources of this type to bear on important educational needs.

The important developments, the theoretical and practical applications of the information gleaned from experimentation with individually prescribed instruction, and selected research findings are all important parts of the IPI Institute.

This manual necessarily includes only limited information and should be considered a point of departure for those interested in using IPI to provide individualized instruction in American schools.

In preparing this manual, major contributions have been made by the following IPI staff members:

Dr. Joseph Lipson
Mrs. Billie Hubrig
Dr. Richard Cox
Mr. Jack Fisher
Mrs. Dorothy Walsh
Miss Sally Calvert
Mrs. Mildred Maley
Mr. James Johnson
Mr. John Grogan
Mrs. Mary Ignatius
Mrs. Brenda Caplan
Mr. Joseph Bruni
Miss Mary Brown
Mrs. Dorothea Dierken
Mrs. Jean Williams

CHAPTER I

History of Individualization[1]

A survey of the history of instruction indicates that formal learning began very much as an individual affair, that is, pupils came to school to receive instruction individually from the teacher. Education was generally for a select few; therefore, fewer pupils attended school. This made possible the provision of individualized instruction for those students. For example, in the one-room school pupils proceeded on an individual basis rather than as intact groups. As educational advantages were offered to a larger fraction of the population, it became necessary to deal with pupils in grade-level groups, and individualized instruction diminished. However, as awareness of individual differences among pupils has increased, many efforts have been made to individualize instruction even within the context of schools offering mass education.

Systematic plans for providing instruction on an individual basis date back as far as 1888 with the work of Preston Search.[2] Washburne[3] and Billet[4] point out that the efforts of Frederick Burke in developing materials for individual instruction are among the best known.

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[1] This brief history of individualization has been drawn from Scanlon, Robert, Dissertation Overview, December 1965.

[2] Wingo, Max G., "Methods of Teaching," Encyclopedia of Educational Research, MacMillan Company, New York, 1960, p. 854.

[3] Washburne, Charleton W., "Burk's Individual System as Developed at Winnetka," Adapting the Schools to Individual Differences, Twenty-Fourth Yearbook, NSSE, Bloomington, Illinois, 1925, pp. 77-82.

[4] Billet, R. O., Provisions for Individual Differences: Marking and Promotion, U. S. Office of Education Bulletin No. 17, 1933, p. 422.

Shane[1] reviewed individual differences in historical perspective of school organization plans. He notes that:

> In general, during the past century, educators have endeavored: (a) to reduce individual differences found in non-graded schools of the seventeenth and eighteenth century by introducing grade levels, (b) to make the graded approach less arbitrary by permitting pupils to progress at different rates of speed on "multiple-tracks" or individualized programs, (c) to organize students within a given grade level through ability grouping, and (d) to introduce ungraded grouping, especially during the early elementary years, as in Milwaukee during the early 1940's.

A historical overview of organizational plans since 1850 indicates that there has been considerable debate and little agreement on the best framework for teaching and learning. Old ideas have continually reappeared on the educational scene. A genuinely novel approach has occasionally made its appearance, but no one best kind of classroom organization has ever found universal acceptance. Shane[2] further notes that the historically significant plans dealing with individual differences within the organization of the school have been related to grouping for instruction.

Experimentation with individualized instruction has demonstrated that it can produce desirable results. Evidence that individualization of school programs can save time, will reduce retardation of students, and is a motivating factor is noted by several researchers.

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[1] Shane, Harold G., "The School and Individual Differences," Individualized Instruction, Sixty-First Yearbook, NSSE, Chicago, Illinois, 1962, p. 48.

[2] Shane, Harold G., "Grouping in the Elementary School," Phi Delta Kappan, April 1960, pp. 313-319.

Henderson[1] and others conclude, "Paced instruction designed to insure success as a reward for individual effort is a prominent characteristic of most corrective programs." They further state, "It is possible that a major effect of this technique is a gradual development of a new self-reliance, which releases the child from a dependence upon others and permits him to deal more effectively with the printed page." Mayer-Oakes[2] reports again of 25 per cent in proportion of students passing the state-wide examination after experience with the Dalton Plan. Peters'[3] findings, based on thirteen experiments, note favorable results for individualizing instruction when comparing the contract plan and the recitation method.

Berson,[4] Jones and Jones,[5] Webster and others,[6] and Goodlad and Anderson[7] have provided research to substantiate great differences among individual pupils. These researchers clearly state that great differences in physical development, motor, intellectual, emotional, and social behavior do exist. Research efforts of Washburne and Marland,[1] Jones,[2] and Peters[3] note attempts to provide for individual differences. Jones[4] also points out that when provisions are made for some of the differences, classroom instruction can be made more effective.

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[1] Henderson, Edmund, Long, Barbara H., and Robert C. Z. Iler, "Self-Social Constructs of Achieving and Non-Achieving Reading," The Reading Teacher, Newark, Delaware, November 1965, p. 117.

[2] Mayer-Oakes, G. H., "The Dalton Plan in a Small High School," Education, LVII, 1936, pp. 244-248.

[3] Peters, C. C., "An Example of Replication of an Experiment for Reliability," Journal Educational Research, XXXII, 1938, p. 38.

[4] Berson, Minnie P., "Individual Differences Among Preschool Children: Four-Year Olds," Individualizing Instruction, Sixty-First Yearbook, NSSE, Chicago, Illinois, 1962, pp. 112-125.

[5] Jones, Harold E., and Mary C. Jones, "Individual Differences in Early Adolescence," Individualizing Instruction, Sixty-First Yearbook, NSSE, Chicago, Illinois, 1962, pp. 126-144.

[6] Webster, Harold, Trow, Martin, and T. R. McConnell, "Individual Differences Among College Freshmen," Individualizing Instruction, Sixty-First Yearbook, NSSE, Chicago, Illinois, 1962, pp. 145-162.

[7] Goodlad, John L. and Robert Anderson, The Nongraded Elementary School, Harcourt, Brace and World, New York, 1959, pp. 1-29.

The limited review of individual difference and attempts at individualized instruction is by no means complete. The previous brief overview only highlights some of the research and programs concerned with individual differences. The central question of concern to most teachers is how to meet the needs of the individual pupil within the context of school systems geared to educate the masses. This problem, as important as it is, is still largely unsolved. The consensus of those who have given serious attention to this problem seems to be that its solution will require rather massive and long-range research and development efforts.

Robert Glaser, Director of the Learning Research and Development Center, in a paper on individualized learning sums up the activity in the area of individualized instruction and sets the tone for this Institute. The following, then, is the Glaser report, "Individualized Learning: Notes on a Rationale of a System of Individually Prescribed Instruction."

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[1] Washburne, Charleton and Sidney P. Marland, Winnetka: The History and Significance of an Educational Experiment, Prentice-Hall, Inc., 1963, p. 402.

[2] Jones, Daisey M., "An Experiment in Adaptation to Individual Differences," Journal of Educational Psychology, XXXIX, 1948, pp. 257-272.

[3] Peters, C. C., "An Example of Replication of an Experiment for Reliability," Journal Educational Research, 1938, p. 38.

[4] Daisey M. Jones, op. cit., pp. 257-72.

INDIVIDUALIZED LEARNING: NOTES ON A RATIONALE OF A SYSTEM OF INDIVIDUALLY PRESCRIBED INSTRUCTION

Robert Glaser

Learning Research and Development Center

University of Pittsburgh

INTRODUCTION

Very early in this century the work of Washburne and Parkhurst sparked concern with "an individual system in education." In retrospect in 1965, the following reasons can be postulated to explain why this activity did not come to fruition. The reasons say why it did not work and why it might work in today's more modern educational climate.

1. The early de-emphasis of subject-matter learning and the emphasis on social learnings went counter to the establishment of a detailed achievement continuum along which the student could proceed. Today's emphasis on subject-matter learning and sequence development may make matters easier.

2. The notion of self-instruction, especially as popularized by programmed instruction was not extant; the present-day emphasis might encourage the use of self-study materials and procedures.

3. It may be that today's techniques of achievement testing, instructional diagnosis, and academic counseling are better prepared to cope with the problem of differentiating between students.

4. Keeping track of the individual student requires extensive

record keeping and analysis. Today's technology of data-processing might help accomplish this huge task.

5. The tradition of separation between the psychometric psychologists and the experimental psychonomes has contributed to an absence of concern with individual differences in learning theory. Present-day signs of collusion are, however, evident.

6. Yesterday's emphasis on a global IQ rather than differentiated aptitudes seems to have worked against the appropriate assignments of students to differentiated learning treatments (one suspects, however, that present-day measurements of IQ and aptitudes may be more predictive of the ability to cope with traditional classroom instruction than they might be under a system of individualized learning.

7. The present-day emphasis of the importance of feedback contingent upon the performance of the learner may make non-individualized learning appear to be a relatively ineffective procedure.

8. Today's notions of operations research and the management of complex of personnel systems might make the administration of a school designed for individualized instruction seem feasible.

9. Computer-assisted instruction with its potential for the presentation and analysis of lesson materials seems feasible.

There are two principle problems in researching and developing systems for implementing individualized learning: (1) the psychological study of the interaction between individual difference variables and learning treatments, and (2) experimentation in school systems with strategies for adapting to individual differences. This latter includes the development of appropriate administrative procedures, teacher training, and especially the development of appropriate instructional materials (including computerized classrooms) and testing instruments.

The best way to get on with the first problem is to do controlled experiments, particularly recommended is the potential of a computer-assisted learning laboratory which will not be elaborated here (except to say that the dynamic updating of student histories of response to subject matter as a basis for assigning future instructional experiments is an exciting venture). The second problem can be discussed by describing the system of individually prescribed instruction being attempted in the Oakleaf School in suburban Pittsburgh.

The project on individually prescribed instruction is a study of the feasibility of procedures for producing an educational environment which is highly responsive to differences among children. The project has been established to re-examine the concept of individualized learning in the light of modern developments.

The instructional process is conceived of as consisting of the following steps: (1) the behavioral specification of educational goals, (2) the detailed assessment of the entering competencies of the learner, (3) guidance of the student from the point of his entering competencies to the behaviors which represent subject-matter mastery as defined by agreed-upon educational objectives, (4) evaluation of the effectiveness of the instructional process and quality control of the educational attainment of each student. This framework sets the components of the task in designing an educational environment for individualized learning; and we will consider, with respect to individualized instruction, the establishment of behavioral goals, the diagnosis of entering competence, the necessary instructional materials, tests, teaching procedures, and evaluation of subject-matter mastery and the path of attainment.

The description that follows represents a first cut at these matters; and it is only an approximation of a full-fledged system with all its nuances and with all the various necessities for the development of the child in the elementary school. Hence, attention has been paid to some things and others have been slighted. Oakleaf's individualized instruction concentrates on subject-matter learning in mathematics, reading, and primary-grade science.

PATTERNS OF INDIVIDUALIZATION

Adapting to individual differences in education can be analyzed in terms of the following patterns (borrowing from Cronbach; also reference Carroll): The patterns to be described are probably not mutually exclusive and range from historical, to present, to future possibilities.

Pattern One assumes fixed educational goals in a fixed educational treatment. Individual differences are taken into account chiefly by dropping students along the way. Tests are used to decide which students should go faster and be imbued with higher-educational aspirations. The social theory involved is that every child should "go as far as his abilities warrant." However, in this case, a weeding-out process, reached earlier or later by various individuals, is assumed. (Under this system, aptitude tests which predict the student's success in school are essentially measures of whatever it takes to foster the pupil's survival in that educational environment.)

A variant of the pattern described above which can be called "adaptation within a pre-determined program" is to permit an individual to stay in school until he, or at least learns to a specified criterion, certain essential and common educational outcomes. Cronbach points out that this procedure has never been followed in any pure form since it would extend the education of some youngsters until they are oldsters. It is practiced, however, in the old policy of keeping the child in the first grade until he can read his primer, and in the more recent non-graded primary unit which some children complete in two years and some in four.

This first pattern of adaptation has two variants then: one in which the duration of instruction is altered for an individual by sequential selection and weeding-out, and the other in which the duration of instruction is altered by training to a fixed criterion. In both of these patterns the educational goal for each student is essentially the same and the instructional treatments provided to the student are fixed.

A second pattern of adaptation to individual differences is to determine for each student his prospective future role and provide for him an appropriate curriculum. We see this system in operation when students are channeled into academic courses, vocational courses, or homemaking courses; or in the decision to give the vocationally oriented students one kind of mathematics and the academically oriented another kind. Cronbach points out the obvious dangers in setting differentiated goals, i.e., differentiating mathematics so that it is the exclusive possession of a selected class while other classes are drilled on formulas useful to shopkeepers. Today the theme in mathematics teaching, and in other subjects, is to give every pupil an understanding of the same basic discipline, even though some students go farther, deeper, and broader. Adaptation to the individual by this second major pattern of "matching goals to the individual" is also operating when a student selects his major field of study in high school or college. (A problem here is that differential aptitude tests for predicting in which academic subjects a person will be most successful have had rather small success.) Adapting to individual differences by this second pattern assumes that an educational system has provision for optional educational objectives, but within each option the instructional treatment is relatively fixed.

A third pattern of adaptation to individual differences attempts to teach different students by different instructional procedures; within each of these instructional treatments there is a minimum fixed sequence of educational goals which must be mastered. This pattern of adaptation can be implemented in a variety of ways: at one extreme a school can provide a fixed instructional sequence and students are pulled off the track for remedial work, and then, when the damage is repaired he is put back into the general track. At the other extreme, an instructional program can provide detailed diagnosis of the student's competences -- his learning habits, achievements and skills -- on the basis of which a unique prescription is made for a course of instruction specifically tailored to that student. In this latter procedure some students might learn on their own by discovery, some learn by more structured methods, some learn by reading, some by listening, etc.

Between these two extremes, toward the direction of the latter, lies the kind of adaptation to individual differences that the Individually Prescribed Instruction plan at Oakleaf hopes to attain. The quality of the system developed depends upon the answer to many research and practical implementation questions. How well can individual student needs be diagnosed? How well can teachers write instructional prescriptions based on student information? What is the character of the information required? Research indicates that in the presence of inadequate information, it may be best for teachers to follow an average treatment for everybody and not attempt to differentiate on the basis of unreliable information; but with reliable information and techniques for making an instructional decision, effective student differentiation is possible. The entire question of the interaction between the characteristics of the student at a particular point in his learning and the methods of instruction is raised. Recently a whole book (Gagne's Center Book) has been devoted to the research questions involved in analyzing the interaction between individual differences and learning procedures. An additional problem is practical determination of the costs and operating techniques that will make the differentiation of instruction suitable to the practical school administrator and to the training of the teacher.

The differentiation of instructional techniques on the basis of individual-differences variables is an ideal which, as has been indicated, will demand detailed analysis that intertwines the methods of experimental psychology and psychometrics. Proof will have to be forthcoming that the selection and devising of instructional methods does indeed interact with student differences so that their achievement in seeking a given educational goal is significantly greater than if an average best method were employed. The Oakleaf project represents a step taken in an on-going school to investigate this interesting problem.

INSTRUCTIONAL DECISION-MAKING (MINIMAL-STYLE)

At present, the Individually Prescribed Instruction procedure does not come near the detailed analysis of student entering behavior and selection of instructional procedures that one day might be possible. Let us examine what it does do. It adapts to individual differences in the following ways.

(1) It starts each pupil from where he is on the learning continuum and takes him from there. It establishes this entering level through a series of detailed placement examinations which establishes the student's attainment in a subject matter and identifies his strengths and weaknesses. A student starts his instruction from this point. At the present time, this identification of the student's "point on the learning continuum" is determined by achievement measures which test his ability to handle the subject matter in a variety of ways. Placement is not made on the basis of aptitude or intelligence tests; the learner is placed according to his present level of performance, not on the basis of predicted potential. The assumption here is that under adequate instruction, performance probably reflects potential and potential measures alone are not effective in identifying relevant learning requirements (A research problem is to identify what kinds of aptitudes go with what kinds of instructional procedures).

(2) The instruction the student receives is differentiated according to his performance as he learns. Curriculum-embedded and sub-goal tests tell whether the student has mastered the subject matter at a required level. On the basis of this performance, new material or materials are prescribed which help him attain mastery of that objective.

(3) Students are differentiated in terms of two kinds of instructional treatments resulting from their ability to extrapolate to new knowledge,

their need for additional practice, and their opportunity for extended experience. Extrapolation refers to the fact that a student may learn an advanced lesson in the process of learning a more basic one; he can transfer his knowledge to more complex performance, and as a result can skip a portion of the curriculum if it is shown that he does not need to be taught it. When a student completes a unit he takes a test not only on what he has covered but also on what he is about to cover next. On the basis of his performance on the latter, it is possible for the teacher to omit certain lessons and prescribe more advanced ones. Additional practice refers to the requirement for more drill and/or different approaches to instruction. Extended experience refers to the fact that at a given level of learning it is possible for a teacher to prescribe excursions which take off from the present level of learning in order to maximize the student's facility for generalization and non-rote thinking. At the present time in Oakleaf, the procedures for taking account of extrapolation and additional practice are much more formalized than our procedures for insuring extended experience. The learning outcomes resulting from extended experience can be tested by achievement measures which require application and extrapolation of what has been learned to novel situations and new problems; carefully-constructed tests need to be built for this purpose.

(4) Quality control of student learning and attainment is accomplished by introducing the concept of mastery levels throughout the curriculum. Performance standards which are used as the basis for making decisions concerning the pupil's future course of instruction are specified. The determination of specific mastery levels for various subject matter is an experimental problem which needs to be studied. How much mastery

should be required, for example, in learning basic arithmetic facts before moving on to an advanced topic? Is more rapid learning and better retention achieved if a student is permitted to go on in a subject matter where advanced lessons depend on previous lessons or is it best to require an early high level of mastery? (In teaching typing, for example, it may be best to permit the beginning typist to make errors without compromising her speed so that eventually both speed and accuracy are learned more efficiently.)

PRACTICES AND PROCEDURES

At the present time, the extent to which the Oakleaf curriculum can provide different instructional procedures for different students is a function of: (1) the kind of materials that have been built into our curriculum for the teachers and students to use; and (2) the way in which the teachers write prescriptions for each student. The prescription-writing procedure is a very essential and tricky aspect of the process at the present time. In order to make wise prescriptions the teacher needs as much information on the student as she can get, plus data about what this information means for the kind of instruction a student should receive. The plan is to provide detailed information about each student's performance to the teacher, or group of teachers, involved in making prescriptions: information about student achievement level, his rate of learning, his impulsivity (fast rate and low achievement), his reflectiveness (slow rate and high achievement), the extent to which he shows vertical transfer, etc. At present, the attempt is made to provide the teacher with more information about the student than she may have ever had before. A computer should print out this information for her. On the basis of this information she can make an instructional decisions which results in a prescription. At the present time these prescriptions reflect primarily the teacher's intuitions and wisdom; this seems to be one of the major tasks of the Oakleaf teachers. However, neither our research nor the research of others as yet gives detailed analysis of the relationship between the student information we provide and the instructional procedure prescribed. This is a crucial area for research. It should be possible to provide student information to the teachers plus information about what materials and instructional procedures to prescribe. They then can use this as a basis for their instructional prescriptions. It is providing information to teachers for computer-aided instructional decision-making which seems to be an immediate next step for study and implementation.

A further aspect of the Oakleaf curriculum is that the materials are so selected so that is is possible for the teacher to manage individualized instruction. It is also hypothesized that some of this management process can be transferred to the student so that he can become a self-resourceful learner through instruction which is largely designed for individual learning. With these kinds of materials the student becomes aware that it is his motivation and his industry which permit the instruction process to proceed.

So what does the Oakleaf system look like: Students are placed where they are on the learning curve and their instruction proceeds from that point. Student performance is carefully tracked and monitored so that information is provided about his attainment level, rate of learning, and subject-matter mastery. Information is provided about the necessity for extended learning which produces mastery and about attained proficiencies which require little or minimal further learning. With the provision of detailed information about student learning progress, the teacher imposes her instructional decisions in the form of prescriptions for the student's subsequent learning steps. This is accomplished in a school organization that permits individualized learning to proceed in the absence of conventional class boundaries.

The development of such a system requires the following components:

(a) The establishment of a continuum of behavioral objectives, which can be a sequential continuum such as is required for mathematics or which can be the kind of continuum required for the less hierarchial social studies. At any rate, what-is-learned-before-what is established, and a student's achievement is defined by his position along an established continuum of learning.

(b) Behavioral objectives are specifically defined so that tests can be prepared on the basis of actual student performance that represent subject-matter competence. Mastery levels are established as an aid to decision-making and instructional diagnosis.

(c) Continuous monitoring and tracking of where the student is at all times is required; the student learns in his own way, and information must be provided to the teacher so that decisions can be made to guide the students. The teacher no longer sees the student as a component of the class but an individual on a continuum of achievement.

Materials are provided which maximize the student's self-instructional capability and provide the teacher with a rich source of materials for differentiation among students.

Testing instruments are very detailed and provide information about placement, differential mastery, and the requirement for additional learning or the ability to attain subject-matter competence with minimal learning.

Automatic data-processing methods are necessitated by the large amount of information that is obtained for each student and that is required for effective instructional decisions by the teacher.

Instructional decision-making in the writing of prescriptions becomes an increasingly important role of the teacher. She cannot assign lessons mechanically and must be flexible on the basis of the information provided to her. Practice and retraining of teachers is required for this important task.

It is to be emphasized that the Oakleaf project is only a small step in the goal of individualized learning not yet having accomplished well what has been described above. The general contention that the juxtaposition of research and practical implementation will force the two to be mutually productive for producing a good system for individualized learning.

The above notes are an introduction; specific technical problems are abundant and must be described. For example, how does one evaluate the effectiveness of individually prescribed instruction. How does one grade and evaluate students in such a learning situation. What are the technical problems not only of student evaluation but of test construction, materials development, teacher training, and so forth. Furthermore, what are the questions to be asked of the data obtained from detailed tracking of the student in individualized learning which can provide a rich resource for studying long-term subject-matter learning?

CHAPTER II

Part 1

Educational Diagnosis

The development of an educational program that provides for individual differences among students requires a clear knowledge of educational objectives. In the late thirties Ralph Tyler gave much prominence to the topic of defining goals of an instructional program. Since that time many changes and developments have occurred. There is little doubt that specifying educational objectives in terms of student behavior is a useful approach for individualizing instructional programs. It simply means changing the behavior of a student so he is able to display a task he did not previously show. Teachers, then, must know what the specific behaviors are and determine when and where they apply. C. M. Lindvall points out:[1]

> The basic consideration in any type of educational planning is that of just what the purposes of education should be. This is true whether the planning is concerned with such relatively broad matters as building plans, staff needs, or the financial budget or with something as limited and specific as what one individual teacher plans to do in a given class on a particular day. Decisions in all such areas must be based on a clear conception of the goals of education. Consequently it is obvious that an essential and continuing task for education is that of defining instructional goals. The skill with which this task is carried out is no small determiner of the effectiveness of any educational program.

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[1] Lindvall, C. M. (Editor), Defining Educational Objectives, "A Report of the Regional Commission on Educational Coordination and the Learning Research and Development Center," University of Pittsburgh Press, 1964, p. 1.

Krathwohl[1] discusses the need to analyze objectives at several levels. He lists three levels and explains each.

> At the first and most abstract level are the quite broad and general statements most helpful in the development of programs of instruction for laying out the types of courses and areas to be covered, and for the general goals toward which several years of education might be aimed or for which an entire unit such as an elementary, junior, or senior high school might strive.
>
> A second and more concrete level, a behavioral objectives orientation helps to analyze broad goals into more specific ones which are useful as the building blocks for curricular instruction. These behaviorally stated objectives are helpful in specifying the goals of an instructional unit, a course, or a sequence of courses.
>
> Third, there is a level needed to create instructional materials -- materials which are operational embodiment of one particular route to the achievement of a curriculum planned at the second and more abstract level of detailed analysis in the programmed instruction movement.

The objectives pointed out by Krathwohl indicate that the first level is relevant to program planning. The second level of objectives relates to curriculum development and the most specific level of instructional development. If we examine the development of a continuum of mathematics skills taught at Oakleaf School, using individually prescribed instruction, we can relate to the levels of instruction indicated by Krathwohl. The philosophy of the Baldwin-Whitehall School District and the aims of American education in general indicate that students study mathematics. This then is the broad general level. Determining the particular course of study and defining of each unit within the mathematics continuum can be considered the second level. Stating the specific objectives of each unit of work in mathematics, then, is the most specific and the third level of instructional development.

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[1] Krathwohl, David R., "Stating Objectives Appropriately for Program, for Curriculum, and for Instructional Material Development," Journal of Teacher Education, March 1965.

The Learning Research and Development Center of the University of Pittsburgh provided the leadership in meeting with classroom teachers to determine the areas of work that children study in learning mathematics (second level). Thirteen specific areas were developed which comprise the mathematics continuum. The thirteen areas are as follows:

1. Numeration - includes counting, use of ordinals, estimating and rounding numbers, prime numbers and other bases.

2. Place Value - includes charting numbers to 100, 1000, values to one million, expotents to base 10 and expotents to 10 cube.

3. Addition - includes adding numbers, expanded notation, carrying, adding negative numbers, decimals, powers to 10, and place value in other bases.

4. Subtraction - includes expanded notation, borrowing, negative and positive numbers, and powers to 10.

5. Multiplication - includes repeated addition, associative and distributive principle, algorithm with 3 digits, decimals and positive and negative numbers.

6. Division - includes partition, inverse to addition, ladder algorithm, remainder and fractions, positive and negative numbers and square root.

7. Combination of Processes - includes word problems, selection and discrimination of process, solving for n, and computing averages.

8. Money - includes the recognition of money, equivalents, practical use of, and use of addition, subtraction, multiplication, and division.

9. Time - includes the study of days, hours, minutes, seconds, decades, centuries, score, fort night, converting to units, and time ones.

10. System of Measurement - includes qualitative dimensional discrimination, equivalent length -- converting units, linear and volume systems, centimeters, and using process of adding, subtracting, etc.

11. Geometry - includes recognition, drawing simple geometric figures, open and closed curve, knowing area, perimeter, calculating circumference, and calculating volume.

12. Fractions - includes the identification 1/4, 1/2, 3/4, equivalent fractions, using the processes of addition, subtraction, etc.

13. Special Topics - begins at level D and includes the study of Roman Numerals, map reading, ratio, per cent, diagrams, etc.

The above listing points out that the broad area of mathematics can be divided into more concise units which are necessary for the study of this subject.

After general agreement by subject specialists from the Learning Research and Development Center and the classroom teachers of Oakleaf School concerning the units of work to be included in mathematics, specific objectives, then, were written. In writing specific objectives, goals must be stated in terms of the behavior that one desires the learner to demonstrate. Mager[1] points out, "A meaningfully stated objective is one that succeeds in communicating to the reader the writer's instructional intent." Mager[2] also lists words that are open to many interpretations and those open to fewer interpretations. This list includes:

---

[1] Mager, Robert F., Preparing Objectives for Programmed Instruction, Fearon Publishers, San Francisco, 1962, p. 10.

[2] Ibid., p. 11.

Many Interpretations	Fewer Interpretations
1. to know	1. to write
2. to understand	2. to recite
3. to really understand	3. to identify
4. to appreciate	4. to differentiate
5. to fully appreciate	5. to solve
6. to grasp the significance of	6. to construct
7. to enjoy	7. to list
8. to believe	8. to compare
9. to have faith in	9. to contract

An example of behaviorally written objectives of the mathematics continuum of Oakleaf School is listed below. The following is a listing of specific objectives for the levels of instruction in the area of addition.

LEVEL A

1. Given two equivalent or non-equivalent sets of objects, up to ten, matches the elements in a one-to-one relationship.

2. Draws or arranges sets of objects to illustrate addition and subtraction facts through six, e.g., add some to make two sets equal, add some to make set match given numeral, circle the correct numeral for pictured addition statements. Same for subtraction.

LEVEL B

1. Circles the correct numeral for pictured addition statements. Fills in missing sums and addends for pictured addition situations. Same for subtraction.

2. Fills in numerals to make "true number sentences" for pictured addition and subtraction situations. Number sentences contain "+," "—," and "=" signs. Places — or + sign into true or not true statements.

3. Completes addition and subtraction statements with missing sums or addends; numbers 0 to 10 with "+" and "−" signs. Problems are written in both horizontal and vertical form. No pictured groups as aids. Timed mastery test. Sums to 10.

4. Selects "other names for numbers" by matching addition expressions (N + N) with pictured groups or numerals, to 10.

5. Writes or completes two equations for a pictured situation which illustrates the inverse relationship of addition and subtraction.

6. Writes or completes two addition equations which then illustrate the commutative principle for addition.

7. Solves or completes one-step word problems with pictures which require the use of addition and subtraction facts through numbers to 10.

8. Uses correctly and recognizes in writing the following: "and," "is," "less," "sum," "difference," "plus," "minus," "equals," "+," "−," "=."

LEVEL C

1. Adds three single digit numbers in different ways to illustrate the associative principle for addition. Uses parentheses, ( ), to show which numbers are added first. Totals to 12.

2. Adds two numbers to sums of 20 using expanded notation when required.

3. Does column addition with two addends and any two or three digit numbers which do not require carrying. Checks addition problems by adding in reverse direction.

4. Places >, < , or = between two addition and/or subtraction expressions to show their relationship to each other. Fills in a missing addend to complete two-step equations which combine addition and subtraction expressions.

5. Works column addition problems with three or more addends and sums to 20.

LEVEL D

1. Demonstrates mastery of addition facts through sums to 20.

2. Does column addition with two addends and three or more digit numbers which do not require carrying. Checks addition problems by adding in reverse direction.

3. Finds the missing addend for problems containing three single digit addends.

4. Uses the words "sum" and "addends" to label the parts of an addition problem.

5. Does simple addition with carrying to tens place, using two digit numerals with two or more addends.

6. Adds with carrying to tens or hundreds place, using three digit numerals with two or more addends.

7. Adds with carrying to tens and hundreds place, using three digit numerals with two or more addends.

8. Finds sums for column addition using three or more addends of one digit.

LEVEL E

1. Does column addition without carrying three or more digit numbers and more than two addends.

2. Uses the commutative principle of addition for two or more place numbers to illustrate that numbers may be added in "any direction," e.g., $475 + 632 = \Delta + 475$ (should be completed without adding).

3. Uses the associative principle for addition to add two or more place numerals.

4. Adds with carrying for four or more place numerals with two addends.

5. Adds two numbers with whole number parts and one or two decimal places (hundredths place).

6. Solves multiple-step word problems requiring addition skills mastered to this point.

LEVEL F

1. Adds with carrying for four or more place numbers with more than two addends.

2. Adds two or more numbers with whole number parts and decimals tc the thousandths place or more.

LEVEL G

1. Locates negative numbers on a number line and a thermometer as preparation for arithmetic operations with negative numbers.

2. Adds two negative numbers using a number line or thermometer as an aid.

3. Adds simple examples of a negative number plus a positive number using the number line or thermometer if necessary.

4. Writes whole numbers or decimal numbers in scientific notation or other exponential notation using positive powers of bases 2 through 10. Adds any two numbers which are multiplied by the same base to the same positive power.

LEVEL H

1. Adds all combinations of negative and positive numbers (more than one digit) without using a number line.

2. Writes small whole numbers or decimal numbers in scientific notation or other exponential notation using negative powers of bases 2 through 10. Adds two numbers which are multiplied by the same base to the same negative power.

3. Adds numbers with decimal parts to the thousandths place or more.

After decisions had been made as to the units of work within the mathematics continuum and the specific objectives to be taught in levels A through H, a specific curriculum was developed. Grouping objectives on a logical basis permitted the development of levels and units of work.

This approach to curriculum building forces the teacher to spell out instructional goals in terms of expected student outcomes. The writing of these precise objectives is no easy assignment. Both Gagne and Mager declare a need that objectives be given the greatest possible specificity so that they can be more easily turned into instructional materials.

They call for several aspects of objective writing: (1) description of the situation which ought to intitate the behavior in question, (2) object or goal of the behavior, and (3) description of the level of performance.

When considering the process of developing behavioral objectives, certain procedures are necessary. These procedures can be related in terms of actually writing the objectives and organizational techniques that may be helpful. Considering the organizational aspects of developing objectives, care must be taken to identify the units of work which comprise the body of subject matter. Precise statements for each specific objective within the unit of work will be necessary. Arranging the objectives into a manageable package is a helpful organizational technique. Sequencing the objectives from the least difficult to the most difficult strengthens the development of the continuum. Considering the actual process of writing behavioral objectives, communication of your intention should be done to the degree that you have described what the learner will be doing when he demonstrates his achievement. Identification and definition of the important conditions under which the behavior is to occur should be part of this process. Definition of the criteria of acceptable performance is also mandated. Finally, each behavioral objective should be a separate statement in precise terms of what to expect the students to do.

CHAPTER II

Part 2
Diagnostic Instruments

The evaluation of pupil progress is an important aspect of individually prescribed instruction. Specific information concerning pupil achievement provides a basis for planning the program of students and is also essential for the effectiveness of the educational procedures being used. C. M. Lindvall and Robert Glaser in a paper presented at the 15th Annual Conference of Directors of State Testing Programs at Princeton, New Jersey, point out:[1]

> Individualized instruction requires that much more information be gained concerning individual pupil progress than is necessary under traditional or group instruction. As long as all instruction is directed toward the one "average" student inaccurate or outdated information concerning pupil abilities will not cause serious difficulties. It is an accepted part of this traditional procedure that instruction directed toward the average student will not really meet the needs of the majority of individuals. But the essence of individualized instruction is that it is tailored to each student and this necessitates the availability of rather exact and continuous data concerning the individual student.
>
> In the IPI program the essential data used are data concerning pupil level of attainment, or, more specifically, data concerning which objectives the student has mastered and which he has not. Such data are used for placing the student at the proper point on the learning continua as well as for planning and guiding his subsequent learning experiences.

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[1] Lindvall, C. M. and Robert Glaser, "The Role of Evaluation in Individually Prescribed Instruction," Learning Research and Development Center, University of Pittsburgh, February 1966, p. 4.

Since the IPI procedure involves having pupils work through instructional sequences by starting at a point determined by their present mastery and then proceeding, step-by-step, through the sequence of behavioral objectives, a key process in the procedure is that of using tests to determine where they should start and to make decisions as to when they are ready to move on from one lesson to the next. To do this a variety of tests are employed.

Based on the behavioral objectives of the continuums, several types of diagnostic instruments have been developed for assessing strengths and weaknesses of each individual.

Four specific types of tests are used in the Individually Prescribed Instruction of Oakleaf School.

Type I: Placement Instruments. Two placement instruments are used to assess mastery of units of work along the learning continuum. The lower level placement instrument measures mastery of objectives from levels A through E in each unit of work. The upper level placement instrument measures mastery of objectives from levels E through I. There is an overlap at level E in the two placement instruments. The placement tests permit a determination of the level at which a pupil should start to work in each learning continuum. Lower level placement instruments are best used with primary students. The upper level placement instruments are for intermediate age students. If a student masters through level E on the lower level test, the upper level would be administered.

If, on the placement test, a student makes a score of 80 per cent or higher on any unit, he is judged as having mastered that unit. Therefore, he is placed within each area (Numeration, Place Value, Addition, etc.)

at the lowest level in which he has a score of 80 per cent or less.

The following graph depicts a student placement profile based on the Lower Level placement instruments. Note that in the units of addition and division the student also took the Upper Level test since he made a score higher than 80 per cent at all levels on the Lower Level test. Also note that there is no placement test for the unit of Special Topics.

NAME ____________________ NUMBER __________

CLASS __________

ARITHMETIC PLACEMENT SCORE PROFILE

			Lower Level								Upper Level					
			B	C	D	E	Tot	Begin Unit			E	F	G	H	Tot	Begin Unit
1. Numeration	Date	Score	30	10	10	10	60	D	Date	Score	10	10	10	25	55	
		Points	30	9	7	6				Points						
		%	100	90	70	60				%						
2. Place Value	Date	Score	X	10	10	10	30	E	Date	Score	10	10	X	6	26	
		Points	X	10	9	6				Points			X			
		%	X	100	90	60				%			X			
3. Addition	Date	Score	20	25	25	20	90	F	Date	Score	20	10	20	10	60	
		Points	20	25	25	17				Points	18	5	0	0		
		%	100	100	100	85				%	90	50	0	0		
4. Subtraction	Date	Score	X	20	18	10	48	E	Date	Score	10	10	10	10	40	
		Points	X	20	18	5				Points						
		%	X	100	100	50				%						
5. Multiplication	Date	Score	X	X	25	30	55	E	Date	Score	30	25	10	10	75	
		Points	X	X	25	15				Points						
		%	X	X	100	50				%						
6. Division	Date	Score	X	X	20	25	45	F	Date	Score	25	10	10	15	60	
		Points	X	X	20	22				Points	23	5	5	0		
		%	X	X	100	80				%	92	50	50	0		
7. Combination of Processes	Date	Score	X	20	20	20	60	D	Date	Score	20	10	10	50		
		Points	X	20	10	10				Points						
		%	X	100	50	50				%						
8. Fractions	Date	Score	10	10	12	20	52	C	Date	Score	20	40	20	10	90	
		Points	9	5	6	5				Points						
		%	90	50	50	25				%						
9. Money	Date	Score	10	10	15	10	45	C	Date	Score	10	10	X	X	20	
		Points	10	5	0	0				Points			X	X		
		%	100	50	0	0				%			X	X		
10. Time	Date	Score	10	10	10	6	36	C	Date	Score	6	10	X	X	16	
		Points	10	8	5	0				Points			X	X		
		%	100	80	50	0				%			X	X		
11. Systems of Measurement	Date	Score	10	6	10	10	36	D	Date	Score	10	10	X	X	20	
		Points	10	6	5	5				Points			X	X		
		%	100	100	50	50				%			X	X		
12. Geometry	Date	Score	10	10	10	10	40	E	Date	Score	10	20	15	10	55	
		Points	10	10	9	5				Points						
		%	100	100	90	50				%						

The placement test data indicate that the student is ready to perform at the following level for each unit.

1. Numeration - Level D
2. Place Value - Level E
3. Addition - Level F (Administration of the upper level test was needed to determine exact placement.)
4. Subtraction - Level E
5. Multiplication - Level E
6. Division - Level F (Administration of the upper level test was needed to determine exact placement.)
7. Combination of Processes - Level D
8. Fractions - Level C
9. Money - Level C
10. Time - Level D
11. Systems of Measurement - Level D
12. Geometry - Level E

The student's profile, based on the placement instruments, can graphically be depicted as follows.

LOWER LEVEL PLACEMENT PROFILE

	Numeration	Place Value	Addition	Subtraction	Multiplication	Division	Combination of Processes	Fractions	Money	Time	Systems of Measurement	Geometry
I												
H												
G												
F												
E			X			X						
D		X	X	X	X	X						X
C	X	X	X	X	X	X	X			X	X	X
B	X	X	X	X	X	X	X	X	X	X	X	X
A	X	X	X	X	X	X	X	X	X	X	X	X

The data on the following pages are for a sixth grade student for whom it was necessary to administer only the upper level placement instrument.

Had this student had lack of mastery at the E level for any particular unit, it would have been necessary to assign the lower level placement test for that unit only.

NAME____________________ NUMBER__________

CLASS______________

ARITHMETIC PLACEMENT SCORE PROFILE

			Lower Level								Upper Level					
			B	C	D	E	Tot	Begin Unit			E	F	G	H	Tot	Begin Unit
	Date	Score	30	10	10	10	60		Date	Score	10	10	10	25	55	
1. Numeration		Points								Points	10	5	5	0		F
		%								%	100	50	50	0		
2. Place Value	Date	Score	X	10	10	10	30		Date	Score	10	10	X	6	26	H
		Points	X							Points	10	10	X	0		
		%	X							%	100	100	X	0		
3. Addition	Date	Score	20	25	25	20	90		Date	Score	20	10	20	10	60	F
		Points								Points	20	5	10	0		
		%								%	100	50	50	0		
4. Subtraction	Date	Score	X	20	18	10	48		Date	Score	10	10	10	10	40	G
		Points	X							Points	10	9	5	5		
		%	X							%	100	90	50	50		
5. Multiplication	Date	Score	X	X	25	30	55		Date	Score	30	25	10	10	75	F
		Points	X	X						Points	30	10	6	4		
		%	X	X						%	100	40	60	40		
6. Division	Date	Score	X	X	20	25	45		Date	Score	25	10	10	15	60	H
		Points	X	X						Points	25	10	9	0		
		%	X	X						%	100	100	90	0		
7. Combination of Processes	Date	Score	X	20	20	20	60		Date	Score	20	10	10	10	50	F
		Points	X							Points	18	7	6	3		
		%	X							%	90	70	60	30		
8. Fractions	Date	Score	10	10	12	20	52		Date	Score	20	40	20	10	90	G
		Points								Points	20	36	10	2		
		%								%	100	90	50	20		
9. Money	Date	Score	10	10	15	10	45		Date	Score	10	10	X	X	20	G
		Points								Points	10	10	X	X		
		%								%	100	100	X	X		
10. Time	Date	Score	10	10	10	6	36		Date	Score	6	10	X	X	16	G
		Points								Points	6	10	X	X		
		%								%	100	100	X	X		
11. Systems of Measurement	Date	Score	10	6	10	10	36		Date	Score	10	10	X	X	20	F
		Points								Points	9	2	X	X		
		%								%	90	20	X	X		
12. Geometry	Date	Score	10	10	10	10	40		Date	Score	10	20	15	10	55	G
		Points								Points	10	18	5	2		
		%								%	100	90	33	20		

The placement instrument has the following characteristics:

1. It measures mastery for each unit of work.
2. It measures the mastery level within each unit of work.
3. It provides a gross profile of any student along the learning continuum.
4. It is an indication of strengths and weaknesses of any student.
5. It focuses on the area or areas that need further exploration for proper diagnosis.

Type II: Pre-Test Instruments. Since each unit and level of work covers several specific objectives, an instrument is needed to discover which specific objective within the unit and level a student knows or does not know. The pre-test instrument then is designed to measure all of the specific objectives within a specific unit. Level E of the addition unit involves the following objectives:

LEVEL E - Addition

1. Does column addition without carrying three or more digit numbers and more than two addends.
2. Uses the commutative principle of addition for two or more place numbers to illustrate that numbers may be added in "any direction," e.g., 475 + 632 = Δ + 475 (should be completed without adding).
3. Uses the associative principle for addition to add two or more place numerals.
4. Adds with carrying for four or more place numerals with two addends.
5. Adds two numbers with whole number parts and one or two decimal places (hundredths place).
6. Solves multiple-step word problems requiring addition skills mastered to this point.

This unit includes six specific objectives which are to be mastered. A student who is placed in this unit on the basis of placement test results may still have mastery of some of these skills. The pre-test instrument, then, helps to decide which objectives he needs to study. Pre-tests are administered to each student before a prescription is developed and before any specific teaching is attempted.

The following functions of the pre-test should be noted:

1. A pre-test is needed for each unit and level of the continuum.
2. The proper pre-test to administer is based on the placement profile of each student.
3. The pre-test measures each specific objective within the one level and unit.
4. Pre-tests are assigned prior to any teaching within the unit.
5. Information as to strengths or weaknesses of each objective within the level and unit of work helps to determine the learning tasks.
6. The pre-test score can be considered the entering behavior of the student for each objective within a level and unit of work.

Type III: Post-Test Instrument. The post-test is an alternative form of the pre-test and is assigned at the end of each unit of work to determine mastery. The post-test score also indicates growth in total behavior for each objective of that level and unit.

If a student's post-test score indicates lack of mastery of certain objectives, additional teaching is demanded and, following this, a second post-test will be administered.

The post-test, then:

1. Is an alternative form of the pre-test.

2. Measures specific objectives within each unit and level of work.

3. Indicates a mastery score for each objective.

4. Can be used for reassignment and re-teaching if mastery is not indicated.

Type IV: Curriculum Embedded Test (CET). The curriculum embedded test is a short test of a particular objective within a level and unit of work. It differs from the pre- and post-test in that it measures only one objective, while the pre- and post-test measures all objectives within a particular level and unit of work. The curriculum embedded test (CET) has two parts. The first part measures a particular objective, and the second part serves as a short pre-test of the next objective within the unit and level of work. Previously, we used the example of level E, addition unit. This unit of work had six specific objectives within it. The CET will help to measure mastery of one objective at a time and provide limited pre-test information for the next objective within the unit and level of work. Objective 1 of level E addition is: Does column addition without carrying three or more digit numbers and more than two addends. If a student has not indicated mastery of this objective from his pre-test, he will be assigned work pertaining to this objective. Part of his assignment will be the CET test. His mastery of the CET for objective 1, level E addition, helps the teacher decide the next assignment for each student. The limited pre-test information on the second half of the CET, covering objective 2, also helps the teacher make decisions as to the need for teaching objective 2, level E addition. The curriculum embedded test has the following functions:

1. Provides specific data on mastery of each specific objective within the learning continuum and is used in decision making concerning pupil advancement.

2. Provides limited pre-test information of the following objective within a level and unit of work.

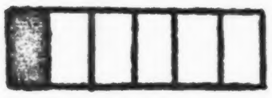
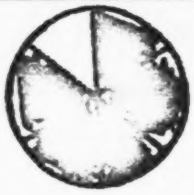
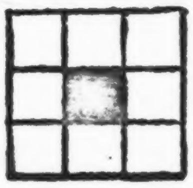
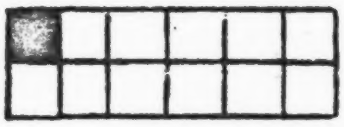
In summary, diagnostic instruments are of four types. The placement instruments provide gross information of mastery based on the level and unit of work. The pre-test instruments measure mastery of all objectives within a level and unit of work. The post-test instrument is an alternative form of the pre-test and provides a mastery criterion for each level and unit of work. The curriculum embedded test measures mastery of each objective within a level and unit of work and provides limited insight into the student competency of the next objective within a level and unit of work. All diagnostic instruments are designed to measure the objectives of the learning continuum.

The following sample diagnostic tests are to be completed by the reader. These include an Upper Level placement test in the area of fractions. It measures gross placement of this one area from level E to level H. A second sample test is a pre-test for level E division. This instrument provides specific knowledge as to strengths and weaknesses and per cent of mastery for each skill in the level E division unit. A third sample test provided is the post-test for level E division. This helps determine when mastery has been achieved. The curriculum embedded test for level E, skills 3 and 4, is also included in this section. Particular attention should be given to the brief pre-test found as part of the curriculum embedded test, level C, skill 3, which measures ability to perform the fourth skill in C addition.

Placement Fractions E **LRDC 8/65**

Name ______________________ Date ______________________

E(1) Directions: In each box circle the fraction that tells what part of the figure is shaded.

 1/4 1/5 1/6 1/8	 1/3 1/6 5/6 2/3
 1/4 1/6 1/8 1/9	 1/6 1/9 1/10 1/12

E(2) Directions: In each circle write >, =, or <, to show how the fractions compare.

3/8 ○ 1/8 1/5 ○ 3/10

1/3 ○ 2/3 2/5 ○ 4/10

E(3) Directions: Complete each equation.

1/4 of 12 = __________ 3/7 of 14 = __________

2/3 of 18 = __________ 5/6 of 12 = __________

Placement Fractions E

E(5) **Directions**: Add the fractions below. Always reduce fractions to lowest terms.

2/6 + 3/6 = __________

2/3 + 1/3 = __________

1/8 + 5/8 = __________

E(6a) **Directions**: Complete each equation.

SAMPLE

1/2 = /4

3/4 = /12

2/3 = /6

3/5 = /15

E(6b) **Directions**: Reduce each fraction below to lowest terms.

10/12 = __________

15/20 = __________

Placement Fractions F

F(1) Directions: Change each improper fraction to a mixed fraction in lowest terms. Leave the proper fractions alone.

14/9 = ____________

6/7 = ____________

21/6 = ____________

Placement Fractions F

F(2a) Directions: Write < , > , or = in each circle to show how the quantities compare.

1/3 ○ 2/3   3/31 ○ 4/31

29/3 ○ 9 1/3

F(2b) Directions: Copy the fractions below so that they are in order from smallest to largest.

2/3   1/2   3/8   1/4

Smallest ________ ________ ________ ________ Largest

Placement Fractions F

F(3) Directions: On the line in each row, write the least common multiple for the numbers in a row.

SAMPLE

2, 1, 4 LCM = 4

4, 2, 8 LCM = ______

3, 2, 5 LCM = ______

2, 6, 4, 3 LCM = ______

F(5) Directions: In each row, write the greatest common factor for the numbers in the row.

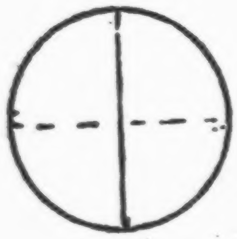
8, 12 GCF = ______

81, 108 GCF = ______

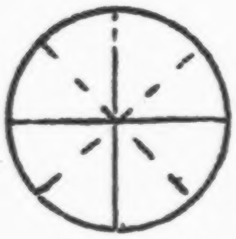
24, 72 GCF = ______

Placement Fractions F

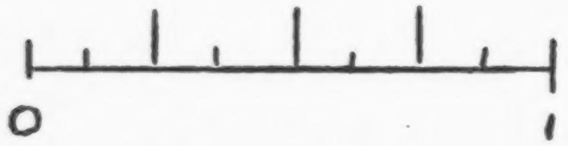
F(4) Directions: Add the fractions. Use the figure to help you.



1/4 + 1/2 = ________



3/4 + 1/8 = ________



1/2 + 3/8 = ________

Placement Fractions F

F(6,7) Directions: Add or subtract as shown. Reduce answers to lowest terms.

(6) 2/3 + 1/6 = __________

7/10 - 3/5 = __________

3/4 + 7/10 = __________

(7) 13/4 - 3/8 = __________

1/4 + 5/6 = __________

5/8 + 3/5 = __________

Placement Fractions F

F(8,9) Directions. Add or subtract as shown. Reduce your answers to lowest terms.

(8)

3/10
7/10
+9/10

2/3
3/4
+5/6

7/9
-3/5

(9)

7 1/9
+8 1/4

4 3/8
+5 1/3

4 2/3
-1 1/24

Placement Fractions F

F(10) Directions: Write < , > , or = in each box to show how the two sides compare.

1/2 + 2/3 ⬡ 11/12

2/13 - 1/7 ⬡ 7/8 - 3/4

(2/3 + 1/6) = 3/4 ⬡ (3/8 + 3/6) - 3/4

Placement Fractions F

F(11a) Directions: Write the decimal equivalent for each fraction below.

1/5 = __________

3/4 = __________

1/8 = __________

F(11b) Directions: Write the simplest fractional equivalent for each decimal below.

.625 = ____________

.2 = ____________

.50 = ____________

Placement Fractions F

F(12) Directions: Solve the problems. Reduce your answers to lowest terms and label them.

1. Sam ate 1/2 of a watermelon. Then Jim and Bob each ate 1/8 of the same watermelon. What part of the watermelon did the three boys eat in all?

Answer ________________

2. Randy rode his bicycle 5/6 of a mile while Tom rode his bicycle 11/15 of a mile. Who rode farther? ________________
How much farther?

Answer ________________

3. In a mile relay race, John ran 3/8 of the way, Mark ran 3/16 of the way, and Ricky ran the rest of the way. What part of the way did Ricky run?

Answer ________________

Placement Fractions G

G(1a) Directions: Find the decimal equivalent to each fraction.

7/20 = ________

1/8 = ________

10/3 = ________

G(1b) Directions: Change each decimal to the equivalent fraction. Reduce all fractions to lowest terms.

.80 = ________

.875 = ________

.08 1/3 = ________

Placement Fractions G

G(2) Directions: Multiply. Reduce your results to lowest terms.

2/7 x 1/2 = ____________ 3/8 x 5/9 = ____________

6/5 x 2/3 = ____________ 3/21 x 7/9 = ____________

G(3) Directions: Divide. Reduce your results to lowest terms.

1/3 ÷ 2/3 = ____________

5/6 ÷ 3/4 = ____________

3/10 ÷ 6/5 = ____________

3/17 ÷ 6/34 = ________

Placement Fractions G

G(4) **Directions:** Multiply. Reduce your results to lowest terms.

2/3 x 1/2 = __________

7 1/6 x 3/16 = __________

10 1/2 x 2/55 = __________

G(5) **Directions:** Divide. Reduce your results to lowest terms.

7/10 ÷ 1/2 = __________

7 ÷ 1 5/9 = __________

5 5/8 ÷ 1 4/6 = __________

Placement Fractions H

H(1) Directions: Find the value of each expression below.

$4^{1/2}$ = ____________

$16^{1/2}$ = ____________

$8^{1/3}$ = ____________

$25^{1/2}$ = ____________

$16^{1/4}$ = ____________

E Division (1) **LRDC 6/65**

Name ______________________ Date ______________________

Directions Fill in the missing numbers.

SAMPLE

A. 18 ÷ 2 = 10 ÷ 2 + 8 ÷ 2

= 5 + 4

= 9

1. 36 ÷ 3 = ___ ÷ 3 + ___ ÷ 3

= ___ + ___

= ___

2. 45 ÷ 5 = ___ ÷ 5 + ___ ÷ 5

= ___ + ___

= ___

3. 28 ÷ 4 = 20 ÷ ___ + 8 ÷ ___

= ___ + ___

= ___

4. 36 ÷ 6 = ___ ÷ 6 + ___ ÷ 6

= ___ + ___

= ___

5. 46 ÷ 2 = ___ ÷ ___ + ___ ÷ ___

= ___ + ___

= ___

E Division (2) LRDC 6/65

Name ____________________ Date ____________________

Directions: Divide using the "ladder" method.

SAMPLE

4)56
-12 | 3
44
-12 | 3
32
-32 | 8
0
14 ans.

5)555
________ ans

6)306
________ ans.

7)637
________ an

9)189
________ ans.

3)9021
________ an

E Division (3,4,5) **LRDC 6/65**

Name ______________________ **Date** ______________________

Directions Divide.

(3) 5)9 3)8 4)9 6)7 2)9

(4) 2)59 5)73 8)62 4)37 3)44

6)29 5)47 9)98 7)82 2)61

(5) Directions: Divide, then check by multiplication.

SAMPLE

63 ÷ 9 = 7

7 x 9 = 63

42 ÷ 6 = ______

___ x ___ = ______

50 ÷ 5 = ______

___ x ___ = ______

21 ÷ 3 = ______

___ x ___ = ______

35 ÷ 7 = ______

___ x ___ = ______

48 ÷ 8 = ______

___ x ___ = ______

E Division (6) **LRDC 6/65**

Name ______________________ **Date** ______________________

Directions: Divide.

2)8	4)36	2)18	9)63	7)14	1)8	5)45	3)6
8)48	6)12	5)15	1)5	4)8	8)8	2)16	4)24
3)9	3)27	1)2	5)40	7)28	9)0	1)7	2)10
8)24	4)12	7)14	5)20	6)36	8)72	2)18	4)16
5)25	1)6	5)10	3)12	9)18	3)21	1)4	6)42

15 ÷ 3 = ____	27 ÷ 9 = ____	9 ÷ 1 = ____	35 ÷ 5 = ____
32 ÷ 4 = ____	49 ÷ 7 = ____	54 ÷ 9 = ____	64 ÷ 8 = ____
36 ÷ 9 = ____	54 ÷ 6 = ____	0 ÷ 8 = ____	14 ÷ 2 = ____
21 ÷ 7 = ____	30 ÷ 5 = ____	4 ÷ 2 = ____	6 ÷ 2 = ____
56 ÷ 8 = ____	18 ÷ 3 = ____	18 ÷ 6 = ____	24 ÷ 3 = ____

E Division (7a) LRDC 6/65

Name ____________________ Date ____________________

Directions: Solve the problems. Write your answer with its label on the lines. If your answer is an amount of money, the dollar sign and point are the only labels needed.

SAMPLE

A. Into how many piles of 3 each can you put 21 books?

Answer 7 piles
(label)

1. The teacher divided 72 pencils equally among eight children. How many pencils did each child receive?

Answer ____________________
(label)

2. John was paid 7¢ an hour for walking the dog. If he earned 84¢, how many hours had he walked the dog?

Answer ____________________
(label)

E Division (7b) LRDC 6/65

Name ______________________ Date ______________________

3. John spent 54¢ on cookies. If each cookie cost 9¢, how many cookies did he buy?

Answer ____________________
(label)

4. The scouts walked 9 miles each day. How long did it take them to walk to their camp and back again if the camp was 27 miles away?

Answer ____________________
(label)

5. Alice had 52 eggs. Ten were brown and the rest were white. Alice put the white eggs into cartons with 6 eggs in each carton. How many cartons did Alice use for the white eggs?

Answer ____________________
(label)

E Division (1) Post **LRDC 6/65**

Name ___________________ **Date** ___________________

Directions: Fill in the missing numbers.

SAMPLE

A. 18 ÷ 2 = 10 ÷ 2 + 8 ÷ 2
= 5 + 4
= 9

1. 16 ÷ 2 = ___ ÷ 2 + ___ ÷ 2
= ___ + ___
= ___

2. 35 ÷ 5 = ___ ÷ 5 + ___ ÷ 5
= ___ + ___
= ___

3. 28 ÷ 4 = 20 ÷ ___ + 8 ÷ ___
= ___ + ___
= ___

4. 36 ÷ 3 = ___ ÷ 3 + ___ ÷ 3
= ___ + ___
= ___

5. 24 ÷ 2 = ___ ÷ ___ + ___ ÷ ___
= ___ + ___
= ___

E Division (2) Post **LRDC 6/65**

Name ______________________ **Date** ______________________

Directions: Divide using the "ladder" method.

SAMPLE

4)56
-12 | 3
44
-12 | 3
32
-32 | 8
0

14 ans.

6)636

____ ans.

5)305

____ ans.

8)648

____ ans.

7)147

____ ans.

3)6031

____ ans.

E Division (3,4,5) Post

LRDC 6/65

Name ____________________ Date ____________________

Directions: Divide.

(3) $7\overline{)9}$ $5\overline{)8}$ $2\overline{)9}$ $5\overline{)7}$ $4\overline{)9}$

(4) $5\overline{)26}$ $2\overline{)73}$ $8\overline{)59}$ $4\overline{)37}$ $3\overline{)55}$

$6\overline{)32}$ $5\overline{)37}$ $9\overline{)97}$ $7\overline{)83}$ $2\overline{)63}$

(5) **Directions:** Divide, then check by multiplication.

SAMPLE

63 ÷ 9 = 7

7 x 9 = 63

72 ÷ 8 = ______

______ x ______ = ______

45 ÷ 9 = ______

______ x ______ = ______

42 ÷ 6 = ______

______ x ______ = ______

32 ÷ 8 = ______

______ x ______ = ______

21 ÷ 3 = ______

______ x ______ = ______

E Division (6) Post **LRDC 6/65**

Name ______________________________ **Date** ______________________________

Directions: Divide.

2)8   4)36   2)18   9)63   7)14   1)8   5)45   3)6

8)48   6)12   5)15   1)5   4)8   8)8   2)16   4)24

3)9   3)27   1)2   5)40   7)28   9)0   1)7   2)10

8)24   4)12   7)14   5)20   6)36   8)72   2)18   4)16

5)25   1)6   5)10   3)12   9)18   3)21   1)4   6)42

15 ÷ 3 = ____   27 ÷ 9 = ____   9 ÷ 1 = ____   35 ÷ 5 = ____

32 ÷ 4 = ____   49 ÷ 7 = ____   54 ÷ 9 = ____   64 ÷ 8 = ____

36 ÷ 9 = ____   54 ÷ 6 = ____   0 ÷ 8 = ____   14 ÷ 2 = ____

21 ÷ 7 = ____   30 ÷ 5 = ____   4 ÷ 2 = ____   6 ÷ 2 = ____

56 ÷ 8 = ____   18 ÷ 3 = ____   18 ÷ 6 = ____   24 ÷ 3 = ____

E Division (7a) Post **LRDC 6/65**

Name ______________________ **Date** ______________________

Directions: Solve the problems. Write your answer with its label on the lines. If your answer is an amount of money, the dollar sign and point are the only labels needed.

SAMPLE

A. Into how many piles of 3 each can you put 21 books?

Answer 7 piles
(label)

---

1. Mrs. Jackson divided 72 donuts equally among nine children. How many donuts did each child receive?

Answer ______________
(label)

2. Jake earned 4¢ for each Sunday Paper he delivered. One Sunday he earned 92¢. How many papers did he deliver that day?

Answer ______________

Name ______________________ Date ________________________

3. John spent 45¢ on model airplanes. If each plane cost 9¢, how many planes did he buy?

Answer ________________ (label)

4. Ventura had 66 seedlings. She put all but 10 of them into pots with 7 seedlings in each pot. How many pots did Ventura use for her seedlings?

Answer ________________ (label)

5. A horse walked 7 miles an hour. How long would it take the horse to walk to the store and back again if the store was 28 miles away?

Answer ________________ (label)

C-Add-3
CEB

Name ____________________ Date ____________________ Room ____________

Directions: Add and check your answer.

$\begin{array}{r} 43 \\ +54 \\ \hline \end{array}$ $\begin{array}{r} 93 \\ +26 \\ \hline \end{array}$ $\begin{array}{r} 56 \\ +32 \\ \hline \end{array}$ $\begin{array}{r} 33 \\ +55 \\ \hline \end{array}$

$\begin{array}{r} 67 \\ +62 \\ \hline \end{array}$ $\begin{array}{r} 85 \\ +14 \\ \hline \end{array}$ $\begin{array}{r} 78 \\ +51 \\ \hline \end{array}$ $\begin{array}{r} 20 \\ +60 \\ \hline \end{array}$

$\begin{array}{r} 37 \\ +61 \\ \hline \end{array}$ $\begin{array}{r} 74 \\ +24 \\ \hline \end{array}$ $\begin{array}{r} 61 \\ +58 \\ \hline \end{array}$ $\begin{array}{r} 14 \\ +15 \\ \hline \end{array}$

$\begin{array}{r} 24 \\ +85 \\ \hline \end{array}$ $\begin{array}{r} 93 \\ +\ 6 \\ \hline \end{array}$ $\begin{array}{r} 86 \\ +\ 2 \\ \hline \end{array}$ $\begin{array}{r} 73 \\ +43 \\ \hline \end{array}$

$\begin{array}{r} 44 \\ +82 \\ \hline \end{array}$ $\begin{array}{r} 36 \\ +43 \\ \hline \end{array}$ $\begin{array}{r} 92 \\ +36 \\ \hline \end{array}$ $\begin{array}{r} 23 \\ +96 \\ \hline \end{array}$

T125

Directions: Put >, = or < in each circle.

1. 4 + 2 ○ 4 - 2
2. 6 - 3 ○ 7 - 4
3. 9 - 5 ○ 5 + 2
4. 4 + 4 ○ 7
5. 6 - 6 ○ 0 + 0
6. 8 - 5 ○ 3
7. 3 + 4 ○ 9 - 1
8. 9 - 3 ○ 3 + 3

C-Add-4
CEB

Name ______________ Date ______________ Room ____________

Directions: Put >, =, < in each △.

8 - 1 △ 8

5 + 3 △ 9

4 + 2 △ 4 - 2

4 + 3 △ 9 - 1

6 - 5 △ 4

7 + 2 △ 9

8 - 4 △ 0 - 4

8 + 4 △ 9 + 2

9 + 3 = ___ △ 6 - 1 = ___

8 + 3 = ___ △ 7 + 4 = ___

7 + 5 = ___ △ 6 + 6 = ___

5 + 5 = ___ △ 6 + 3 = ___

Directions: Fill in the missing numerals.

5 + 4 = ___ = 3 + 6

7 + 5 = ___ = 6 + ___

9 - ___ = 8 - 4

11 - 1 = 2 + ___

CHAPTER II

Part 3

Materials

The key elements in Individually Prescribed Instruction are the instructional materials that are used by the pupil to gain mastery of the stated objectives. Under IPI much of the studying by pupils must be done independently with a minimum of direct instruction by the teacher. This means that the lesson materials must carry most of the burden of instruction. As a result, greater care must be used in selecting and constructing materials than is necessary in situations where detailed explanations by the teacher can be used to compensate for any inadequacies.

One useful types of lesson material that meets these requirements is that found in programmed textbooks or workbooks. Where the Learning Research and Development Center was able to locate programmed materials that teach the IPI objectives, such materials have been used. However, only a minimum number of appropriate programs have been found. This means that other self-instructional materials have had to be identified or developed. This has resulted in the extensive use of workbook pages, recorded lessons, and individual reading materials. In adapting or developing these materials, a stress has been placed on producing detailed directions for the students so that the lessons can be used with a minimum amount of teacher explanation.

In securing the needed materials, the work that was devoted to the detailed specification of behavioral objectives has been of gread aid. When the learning continuum is so written that its meaning is clear to its readers, material selection is easier to prepare or locate. Also, if an example of an activity is provided for each objective, this helps in selecting and preparing materials.

Materials should be selected or prepared for each specific objective from the learning continuum. Care must be taken in constructing materials to incorporate skills already mastered. The primary purpose of the material is, however, to provide students with the opportunity to practice the particular objective listed on the learning continuum. This may seem limited in scope, but it is important that each piece of material teach and provide practice for the objective desired.

When preparing or selecting materials, careful consideration must be given to the possible range of age and interest of individual students. A student in second grade and a student in fifth grade may be working on the same objective; materials then must be suitable to the needs of both. Consideration of a suitable vocabulary, student interests and previous experiences, and type of directions necessary are just a few suggestions that must enter into the preparation of suitable materials.

The organizational problems of developing vast quantities of materials should not be overlooked. Materials being prepared are needed for the students to practice the desired behavior, the teacher who will be prescribing the materials, the clerks or teacher aides who will score the material, and self-scoring materials for student use. This means preparing materials from four points of view. Answer keys, for example, should be prepared during the preparation of student materials. Careful consideration must be given to the storage and housing problems of the materials, as well as the numbering system to be employed. The Oakleaf numbering system is based on the level and unit of work. For example, the unit of Addition is numbered 1 through 250 for level A, repeating this process for each level of work. Materials should be easily identified as to level, unit, and skill; therefore, this information should appear on each piece of material.

Materials used in Individually Prescribed Instruction must be such that they require the pupil to practice the skill that he is to master. Materials should not be of the type that merely requires the pupil to read about the objective he is to learn. Materials must be of the "doing" nature for children rather than of the explanation type.

Pre-packaging of lesson materials must be taken into consideration. All materials, covering the entire curriculum sequence, should be available in complete form prior to implementation of IPI. Insistence on the pre-planning of the total lesson sequence does not mean modofication of materials or development of new materials should not take place during the course of the school year. A basic structure which can be used is essential in IPI.

Materials need to be prepared in a form which facilitates the preparation of individualized sequences for each student. Oakleaf School uses loose lesson pages as the nucleus of lesson materials. These loose materials can be arranged in whatever order is desired.

Finally, procedures should be established to permit lesson materials to be continuously analyzed on the basis of pupil performance. Decisions as to the worth of material and need to develop new materials should be based on data taken from student performance.

The following objectives are taken from the Oakleaf Continuum. It is suggested that these objectives be used as a basis for practice in writing lesson materials that meet the foregoing criteria.

Level	Area	Objective
D	Addition	Finds the missing addend for problems containing three single digit addends.
E	Numeration	Identifies odd and even numbers and states (and uses) rules for adding, subtracting, and multiplying two numbers.
F	Comprehension	Selects details which are relevant to the principal facts in a paragraph.
G	Comprehension	Paraphrase the author by stating in written form in one sentence the content of the paragraph.
H	Comprehension	- Identify facts as different from opinion by selecting sentences that illustrate a fact and those that illustrate opinion.

CHAPTER III

Prescription Writing

The diagnostic instruments based on the objectives of the learning continuum and the materials prepared for each objective permit the teacher to consider instructional uses. To individualize instruction, careful consideration of student curricular strengths and weaknesses and learning characteristics are mandatory. Certain facets of information about each student should be reviewed and analyzed prior to the initial prescription for learning.

1. Analysis of Student Background. A comprehensive survey of student background information is necessary. Careful review of school records can help the prescription writer ascertain an approximation of a student's ability and maturation. This review should include a careful analysis of past achievement tests, readiness tests, reading records, previous grades, years in school, chronological age, and mental age. Cumulative information including anecdotal notes and sociograms, if available, plus school health records, etc., are primary sources for this information.

2. Analysis of Placement Test Results. The placement instrument provides a gross picture of each student as to mastery level of each unit of work along the learning continuum. It is important at this point for teachers to become familiar with the entire placement picture for each student and each subject. Analysis of placement test results may take place during the analysis of student background information. Analysis of this information reveals the beginning level of instruction for each

area of work. It also provides the sequence of instruction for each student. The following chart summarizes placement test data for two students and indicates the sequential order in which units would be assigned.

STUDENT A

Unit	Placement Level	Sequence for Assigning Units			
Numeration	E		3	9	19
Place Value	E		4	10	20
Addition	D	1	5	11	21
Subtraction	E		6	12	22
Multiplication	D	2	7	13	23
Division	F			14	24
Combination of Processes	E		8	15	25
Fractions	F			16	26
Money	G				27
Time	G				28
System of Measurement	F			17	29
Geometry	F			18	30

STUDENT B

Unit	Placement Level	Sequence for Assigning Units		
Numeration	D	1	4	—
Place Value	E		—	—
Addition	F			—
Subtraction	F			—
Multiplication	D	2	—	—
Division	E		—	—
Combination of Processes	F			—
Fractions	F			—
Money	D	3	—	—
Time	G		—	—
System of Measurement	F			—
Geometry				—

Studnet A's placement results indicate that level D in the area of addition is the lowest in which he has been placed. Note that the multiplication mastery level is also D. Since care has been taken to sequence the units in terms of prerequisite areas, addition appears before multiplication. Therefore, addition is the first unit in the sequence in which instruction should be provided. Also notice that the sequence of instruction for Student A is such that during the 30 assignment, the addition and multiplication units are prescribed four times each and the money and time units only once each. This assumes that Student A mastered level D addition and raised the original mastery level from D to E, etc.

Student B's placement results indicate that he is at level D in the units of numeration, multiplication, and money. Following the sequence of instruction and using what you have learned from the example of Student A, complete the sequence for Student B. Notice that the sequence for both students is entirely different and is based on the student's own success with the curriculum material.

3. Administration and Analysis of Pre-Test Information. Based on the results of the placement instrument, a decision can be made as to administration of the first unit pre-test. The pre-test analyzes the mastery of the specific skills within a particular unit. Only one pre-test is given at a time. Looking again at Student A, he would be assigned the pre-test in level D addition, the unit with which he is to begin study. It is entirely possible for students to evidence mastery of a unit pre-test. When this happens, the next unit pre-test in the sequence is assigned. The unit pre-test measures mastery of each specific skill assigned to this unit. Unit pre-tests, then, provide the following information: (1) the strengths and weaknesses of the student for each skill, and (2) the per cent of mastery the student has exhibited for each particular skill. Using this information, the first prescription can be prepared.

Prescription writing for each student is a plan for that individual to improve and master a particular objective or skill on the learning continuum. The careful analysis of background data, placement, and pre-test results has provided direction for the prescription. The placement test has identified the unit and level of work for each student and the pre-test has indicated the specific skill and entering mastery score within the unit. The background information has indicated the unique characteristics of the student.

The initial prescription should indicate the level of work and the

skills to be mastered. One skill at a time will be prescribed, making every attempt to raise the entering behavior score to a mastery level. The prescription must indicate:

1. **The kinds of instructional material to be used. Will this be self-instructional material, textbook assignment, or manipulative devices?**

2. **How many materials or pages the student is to complete.**

The sample prescription that follows should be studied carefully. The basic information of name, class, level and unit are recorded at the top of each prescription. Notice the numbers 1,4,5,6,7,9,10 that appear after the unit. These are the skills that the student should master. This information was recorded from the Unit Pre-Test for level E multiplication. The pre-test scores are recorded on the back of the prescription.

This is a completed prescription. The beginning and ending dates have been recorded and the prescription indicates that the student worked eleven days from the pre-test to the post-test. The prescription also indicates that the pre-test score was 54% and the post-test score 96%.

Notice the pages assigned for each skill, particularly the scores on the curriculum tests. The second prescription, skill 4, had a 100% score for part of the curriculum test. Part 2 of this same test, which is a limited pre-test of skill 5, had a score of 20%. Notice the different strategies employed, based on the results of both parts of the curriculum test. The information found on page 77 of this manual normally appears on the back of the regular prescription blank.

Mastery / Pull

Name________________ Class 4 Page 1

Level E Unit Multiplication 1-4-5-6-7-9-10

Unit Tests

		Pre 1	Pre 2	Post 1	Post 2	Post 3	Post 4
Score	90	49		86			
	%	54		96			
	Date	5/16		6/6			

Begin	5/20	173
End	6/6	183
Days Worked		11

	Worksheets								Curriculum Test						
	Date Pres.	Pres. Init.	Page No.	Skill No.	Items	Score	Date	Sc's Init.	Part 1 Items		%	Part 2 Items		%	Sc's Init.
1	5-20	J.J.	E 156	1	42	39	5/23	ds							
			157		15	15	5/23	ds							
			159		24	24	5/23	ds							
			160				5/24	d.S.	16	14	88	3	3	100	
5	5/24	1919	E 174	4	5	5	5/24								
			175		25	25	5/24								
			177		19	19	5/24								
			180		19	18	5/24								
			193				6/1	G.M.	20	20	100	5	1	20	
10	6/1	J.J.	E 194	5	8	8	6/1	d.s.							
			195		10	10	6/1	d.s							
			199				6/1	I.L.	15	15	100	2	2	100	
	6/2	J.J.	E 213	6			6/2	I.L.	14	14	100	4	4	100	
	6/3	J.J.	E 251	7			6/3	GM	4	4	100	6	6	100	
15	6/4	J.J.	E 261	9			6/4	GM	12	12	100	4	4	100	
	6/5	J.J.	E 281	10			6/5	GM	15	15	100				
			Take 1st Post-test												
20															
25															
30															

LEVEL E

Numeration

T	Pgs	Pgs	Pgs	Pgs	Skill	Pts	Pre	°/°	Post	°/°	Post	°/°	Post	°/°	Post	°/°
					1	10										
					2	10										
					3	10										
					4	10										
					Total	40										
T	4	3	2	1	°/°											
					Date											
					Time											

Place Value

					1a	6										
					1b	4										
					1c	10										
					2	10										
					Total	30										
T	4	3	2	1	°/°											
					Date											
					Time											

Addition

					1	10										
					2,3	10										
					4,5	10										
					6	10										
					Total	40										
T	4	3	2	1	°/°											
					Date											
					Time											

Subtraction

					1,2	10										
					3a	4										
					3b	6										
					Total	20										
T	4	3	2	1	°/°											
					Date											
					Time											

Multiplication

				4	1	10	6	60	10	100						
					2	10	10	100	10	100						
					3	10	10	100	10	100						
				5	4	10	4	40	8	80						
					5,6,9	20	3	15	18	90						
				1	7	10	2	20	10	100						
					8	10	10	100	10	100						
				1	10a	4	2	50	4	100						
					10b	6	2	33	6	100						
11				11	Total	90	49		86							
T	4	3	2	1	°/°		54		96							
					Date		5/16		6/6							
					Time											

As each student begins his assignment task, based on the teacher prepared prescription, the ability to help each individual is a major consideration for the teacher. Timing, that is, judging the amount of time to be provided to each student, is a challenge teachers must face. Consideration must also be given to the problem of writing prescriptions during class time. Since each prescription is limited to one objective and since mastery of that objective will affect the next prescription, it is reasonable to assume that prescriptions will be written during class time.

As each youngster proceeds with his prescription, the teacher must carefully analyze student progress. Therefore, the prescription must be a continuous record of how well each student masters the materials assigned. Using the performance that each student shows on the materials assigned to enable him to master the given objective, the teacher will either prescribe additional work or assign the curriculum embedded test.

The curriculum embedded tests (CET) were described in Chapter II. The CET is a short quiz measuring the mastery of each objective and providing a limited pre-test of the next objective. Mastery of the curriculum embedded test is a good indication of mastery of the objective. Several considerations and alternatives should be kept in mind when writing prescriptions and using the curriculum embedded tests.

1. The CET is assigned as part of the second prescription after the teacher has analyzed the student's material as he works with his assignment to master an objective.
2. The first part of the CET measures mastery of the assigned objective; the second part, below the double line, is a pre-test of the next objective.
3. If the CET is mastered, the next prescription is based on the pre-test from the CET and the original pre-test.

4. If a student, based on the original pre-test of a unit, needs work in objectives 2, 3, 4, and 5, the CET for objective 2 is assigned when the student's performance indicates he is ready.

5. If the student has mastery of CET, objective 2, the teacher then writes the next prescription for objective 3.

6. If the pre-test from CET, objective 2, indicates a mastery of objective 3, the next prescription or the first student assignment in objective 3 is the CET objective 3.

7. If a student fails to achieve mastery of the CET, the student prescription is a re-teaching of the objective, changing strategy and eventually reassigning the CET.

The curriculum embedded test provides key data for prescription writing. Based on careful analysis of this test, direction for the next prescription is given.

When the student has proceeded to master all of the objectives that were identified by the pre-test for the unit, the post-test is assigned to ascertain mastery level of all objectives within the unit. Lack of mastery on the post-test indicates the need for re-teaching and eventually another post-test. Mastery of the post-test dictates a repeating of the processes of prescription writing for the next unit.

A "prescription" blank for Student A, with some basic information included, is found on the next page. Using information from Chapters II and III, answer the following questions.

1. What pre-test should be assigned to Student A?
   ____

2. If the pre-test indicates that Student A needs additional work in skills 2, 3, 5, and 7, for what skill will the first prescription be written? ______________________
   ____

3. What specific behavior should Student A exhibit when he has mastered skill 2? ______________________
   ____

4. When will the CET be assigned to Student A for skill 2?
   ____

5. What specific information will the CET for skill 2 provide to the prescription writer about skill 3?
   ____
   ____

6. When will the post-test be assigned to Student A?
   ____

Using the materials provided by the instructor, write the first prescription for Student A, the second prescription, etc.

Name STUDENT A Class 4 Page 1

Level D Unit Addition - Skills

Begin	
End	
Days Worked	

Unit Tests

		Pre 1	Pre 2	Post 1	Post 2	Post 3	Post 4
Score							
	%						
	Date						

	Worksheets								Curriculum Test				
	Date Pres.	Pres. Init.	Page No.	Skill	Items	Score	Date	Sc's Init.	Part 1 Items	Part 1 %	Part 2 Items	Part 2 %	Sc's Init.
1													
5													
10													
15													
20													
25													
30													

CHAPTER IV

Teaching Techniques

A variety of teaching techniques have long been practiced by teachers. Lecture, discussion, recitation, laboratory, and project methods are only a few. This section will provide a limited review of various teaching techniques and how they apply in individually prescribed instruction.

The teaching function in individually prescribed instruction begins with diagnosis of strengths and weaknesses of students, including the preparation of the specific prescription for each individual. The role of the teacher in individually prescribed instruction, after initial diagnosis and prescription preparation, focuses on several key points : first, interacting with the students individually by providing precise, clear, and relevant information when it is needed. This strategy might be considered tutorial in nature, but has several implications for teacher behavior. This implies that the teacher must have command of a wide range of the curriculum. It also implies the ability to "change gears" and provide instruction when needed. Second, practicing diagnostic techniques, pinpointing instructional problems, and assigning appropriate tasks are part of the teacher's role in individually prescribed instruction.

It appears safe to assume that the most common teaching technique used today is lecturing. In most cases, this implies the teacher talking to a group of students who are presumably listening. The teacher determines the quantity, pace, and scope of the material to be mastered. Individually prescribed instruction provides an opportunity to use the lecturing technique. However, lecturing is usually aimed at one student with a specific learning problem. The student has to some degree determined the pace and scope of the material.

Seminar days have been successfully used in the IPI project. It is at this time that teachers bring together common problems, permit students to share learnings, and generally conduct a discussion lesson. Traditionally, the discussion method is characterized as a situation in which teachers play a non-committal, mediating role. Proponents of the discussion method usually claim that this method has advantages for problem solving, application of knowledge, changing attitudes, interpersonal relations, and self concepts. IPI does not rule out the discussion method as one technique of teaching children. Seminar days, as pointed out above, and small group instruction for students with similar learning disabilities permit use of the discussion method.

The project method is characterized by the acceptance of an assignment by the student, who is then expected to fulfill the requirements either independently or in a small group situation. The teacher is available for help when required or requested. IPI uses and extends this approach in the teaching-learning situation.

The recitation method usually includes assignments, student study, and reporting either to the teacher or the class. This method is sometimes considered to be the traditional method of teaching and is very common as a teaching method. IPI may at times require the recitation method to be employed. For example, students may be assigned a particular library book to read and report their findings and information to the classroom teacher or to the class as a whole.

Individually prescribed instruction at times uses most of the methods listed above with the basic difference being the emphasis on the individual rather than group or class situations.

Wallen and Travers,[1] present major conclusions in view of the interest in group procedures. They present the following generalizations for interacting (discussion) and non-interacting (lecture) group situations.

> 1. Judgments based on group consensus are not necessarily more accurate than the average judgment by individual members of the group but are likely to be so when the material is unfamiliar or there is a great range of individual judgment.
>
> 2. Group problem solving is not necessarily superior to the average solution by the individual members of the group, but is likely to be so when individuals are previously familiar with the type of problem and bring with them skills which are pertinent to the problem. Group solutions are likely to be inferior to the best individual solutions.
>
> 3. The advantage in groups in problem solving appear to be more facilitating rejection of incorrect approaches than in providing more approaches to the problem.
>
> 4. Group interaction is likely to be of most benefit to those persons making poorest individual judgments or solutions to problems.
>
> 5. Group superiority, where found, is a function of the quality of the individual contributions of members.
>
> 6. If evaluated in terms of man-hours to solutions, group process is generally, and often strikingly, less efficient.

---

[1] Wallen, Norman E. and Travers, Robert W., "Analysis and Investigation of Teaching Method," Handbook of Research on Teaching, (Edited by N. L. Gage), Rand McNally & Co., 1963, pp. 482-483.

7. The mere presence of other persons has an effect on individual performance.

8. Group process appears more effective than direct attack in changing expressed attitude.

It appears safe to assume, based on the generalizations of Wallen and Travers, that the success of the method used in teaching depends greatly on the skill of the user and the expected outcome of the class.

Individually prescribed instruction differs from each method based on point of emphasis and concentration of students' strengths and weaknesses. Of primary concern to the teacher in the IPI program is providing materials that will permit the student to practice the desired behavior. The meaningfulness of this material can be noted and measured as the student proceeds with his assigned task. Whether the actual situation under which this practice takes place is individual or group depends greatly on the student involved and the task at hand. Traditionally, teachers are concerned with explaining learning to a group of students. The explanation is geared for a wide range of ability levels and assumes that it is understood and that the children are listening.

Individually prescribed instruction is concerned with pupil needs and areas of weakness. The prescription writing process focuses on individual strengths and weaknesses and attempts to permit children to work in the area between the realm of what they know and that which they do not know.

The diagnostic procedures built into the model of Individually Prescribed Instruction, through careful analysis of background information and diagnostic instruments, permits the classroom teacher to function differently. Focusing on strengths and weaknesses, assigning appropriate learning materials, and providing the needed flexibility of the teaching-learning situation are diagnostic functions. Traditionally, teachers have served as dispensers of knowledge, providing either the information sought by students or suggestion sources where it might be found. We must remember that diagnostic instruments are not yet readily available to classroom teachers; therefore, the function of the diagnostician would be a more difficult role for the traditional classroom teacher.

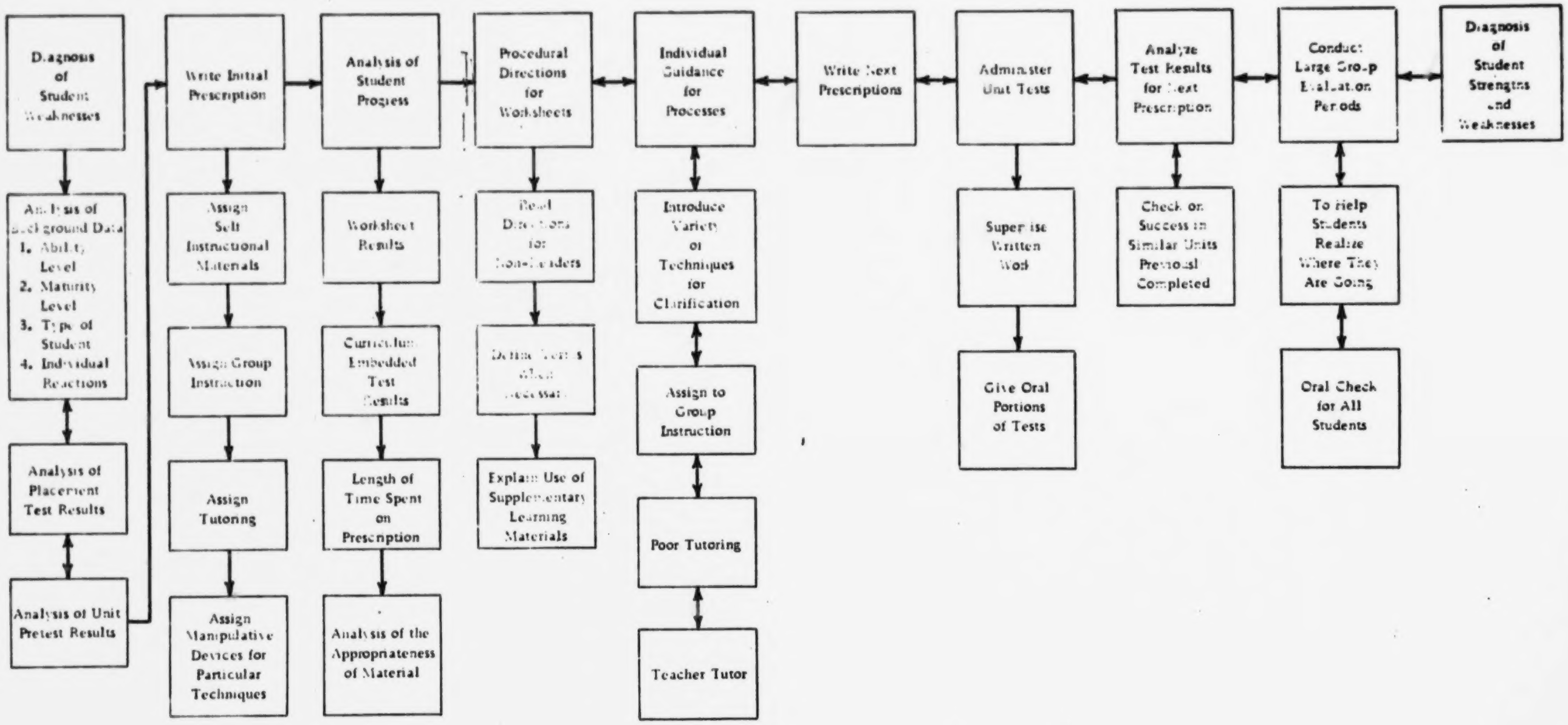
An important contrast between IPI and other methods is the aspect of self-evaluation of materials presented. Individually prescribed instruction permits teachers to continuously evaluate the materials and procedures used in learning a particular objective. Traditionally, teachers do not generally self-evaluate the success of a lesson plan in providing adequate instruction.

The teaching procedures used under IPI contrast somewhat with those used in conventional instruction. This can be presented in terms of contrasting questions that the teacher poses for himself as he approaches the instructional situation.

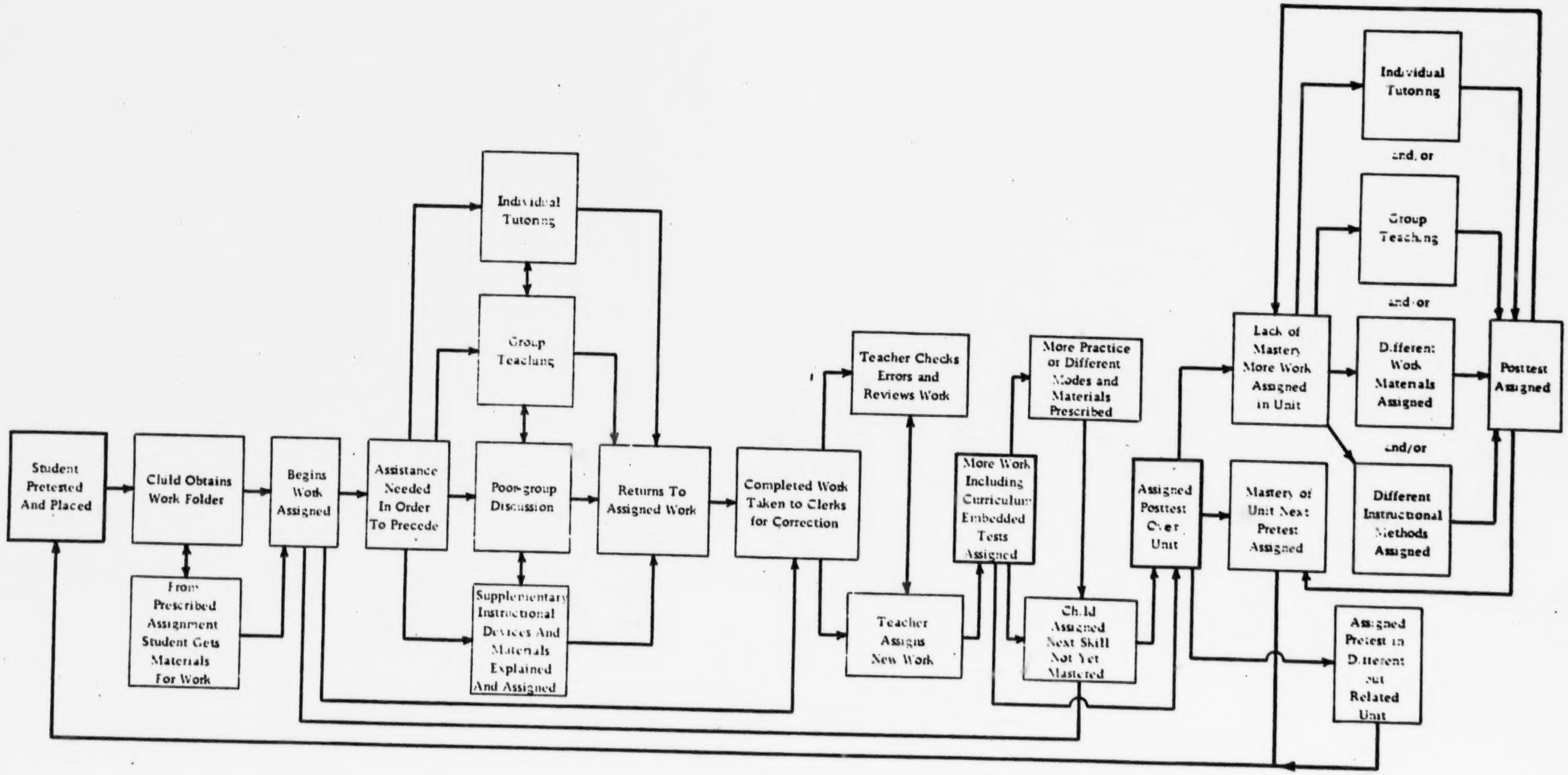
Non-IPI	IPI
1) How can I explain this?	1) What should I have the student do to actually practice this behavior?
2) How should I address this group?	2) What kind of help does this pupil need to master this material?
3) What topic should I cover today?	3) Where is each individual student in terms of the learning continuum?
4) What is wrong with these pupils that keeps them from learning what I am presenting?	4) How can these materials and procedures be modified so that pupils learn more readily?

Two flow charts are included in this section. The flow chart of teacher functions depicts the teacher role during Individually Prescribed Instruction. The flow chart of student progression coincides with the teacher function chart. Both charts should be carefully studied and revised during the course of the Institute.

FLOW CHART OF TEACHER FUNCTIONS


Diagnosis of Student Weaknesses
Analysis of Background Data
1. Ability Level
2. Maturity Level
3. Type of Student
4. Individual Reactions
Analysis of Placement Test Results
Analysis of Unit Pretest Results
Write Initial Prescription
Assign Self Instructional Materials
Assign Group Instruction
Assign Tutoring
Assign Manipulative Devices for Particular Techniques
Analysis of Student Progress
Worksheet Results
Curriculum Embedded Test Results
Length of Time Spent on Prescription
Analysis of the Appropriateness of Material
Procedural Directions for Worksheets
Read Directions for Non-Readers
Define Terms When Necessary
Explain Use of Supplementary Learning Materials
Individual Guidance for Processes
Introduce Variety of Techniques for Clarification
Assign to Group Instruction
Poor Tutoring
Teacher Tutor
Write Next Prescriptions
Administer Unit Tests
Supervise Written Work
Give Oral Portions of Tests
Analyze Test Results for Next Prescription
Check on Success in Similar Units Previously Completed
Conduct Large Group Evaluation Periods
To Help Students Realize Where They Are Going
Oral Check for All Students
Diagnosis of Student Strengths and Weaknesses

FLOW CHART FOR STUDENT PROGRESSION


Student Pretested And Placed
Child Obtains Work Folder
From Prescribed Assignment Student Gets Materials For Work
Begins Work Assigned
Assistance Needed In Order To Precede
Individual Tutoring
Group Teaching
Peer-group Discussion
Supplementary Instructional Devices And Materials Explained And Assigned
Returns To Assigned Work
Completed Work Taken to Clerks for Correction
Teacher Checks Errors and Reviews Work
Teacher Assigns New Work
More Work Including Curriculum Embedded Tests Assigned
More Practice or Different Modes and Materials Prescribed
Child Assigned Next Skill Not Yet Mastered
Assigned Posttest Over Unit
Lack of Mastery More Work Assigned in Unit
Mastery of Unit Next Pretest Assigned
Assigned Pretest in Different but Related Unit
Individual Tutoring
and/or
Group Teaching
and/or
Different Work Materials Assigned
and/or
Different Instructional Methods Assigned
Posttest Assigned

CHAPTER V

Administration of IPI

The development and administration of a learning climate that can provide for individual differences requires careful consideration of the following aspects of instruction as they relate to individuals: (1) establishing sequentially stated curricular objectives, (2) developing a procedure for diagnosis of student achievement in relation to the stated objective, (3) providing materials to teach each objective, (4) establishing various modes of instruction to attain mastery of any given objective, (5) providing for continuous feedback and evaluation, and (6) organizing the school to enhance the teaching-learning function.

Previous sections have dealt with educational diagnosis, prescription writing, and teaching techniques. Therefore, concentration in this section will be on organization of the school and roles of specialists, including non-professional employees.

The planning for and implementation of the IPI project has presented many challenges. Accordingly, the staff had to make certain assumptions about children and how they learn. C. M. Lindvall and John Bolvin list these assumptions as follows:[1]

> 1. One obvious way in which pupils differ is in the amount of time and practice that it takes to master given instructional objectives.

---

[1] Lindvall, C. M. and John O. Bolvin, A Report on the Oakleaf Project for Individually Prescribed Instruction, University of Pittsburgh, Learning Research and Development Center, 1965, pp. 3-4.

2. One important aspect of providing for individual differences is to arrange conditions so that each student can work through the sequence of instructional units at his own pace and with the same amount of practice he needs.

3. If a school has the proper types of study materials, elementary school pupils, working in a tutorial environment which emphasizes self-learning, can learn with a minimum amount of direct teacher instruction.

4. In working through a sequence of instructional units, no pupil should be permitted to start work on a new unit until he has acquired a specific minimum degree of mastery of the material in the units identified as prerequisite to it.

5. If pupils are to be permitted and encouraged to proceed at individual rates, it is important for both the individual pupil and for the teacher that the program provide for frequent evaluations of pupil progress which can provide a basis for the development of individual instructional prescriptions.

6. Professionally trained teachers are employing themselves most productively when they are performing such tasks as instructing individual pupils or small groups, diagnosing pupil needs, and planning instructional programs, rather than carrying out such clerical duties as keeping records, scoring tests, etc. The efficiency and economy of a school program can be increased by employing clerical help to relieve teachers of many non-teaching duties.

7. Each pupil can assume more responsibility for planning and carrying out his own program of study than is permitted in most classrooms.

8. Learning can be enhanced, both for the tutor and the one being tutored, if pupils are permitted to help one another in certain ways.

Leadership in any organization is vital and a key element in its success. The same, of course, is true in a system that is making a serious attempt to provide for individual differences. An overview of the responsibilities of an elementary administrator includes functioning in several broad categories. The scope and function of an elementary administrator includes: (1) duties pertaining to the curriculum and teaching methods, (2) supervision of professional and non-professional employees, (3) developing parent and community relations, (4) organizing school business management affairs, and (5) duties related to special fields and services. The above listing of functions might be further subdivided into administrative-clerical and instructional-curricular in nature.

In designing this type of educational schedule the administrator must consider the educational goals, the instructional staff, the pupils, and the physical plant. Consideration of the eight assumptions listed above will alter scheduling for instruction within the school. In more specific terms the educational goals of individualizing instruction include: (1) permitting the student to work through a sequence of objectives at their own rate with the amount of practice that each needs, (2) permitting self-learning as much as possible, (3) providing verbal interaction with teachers or with peers where necessary, and (4) providing opportunities to acquire a specific minimum degree of mastery before moving on from a specific task.

In order to provide the necessary interaction of the various aspects related to the scheduling of IPI at the Oakleaf School, the students are divided into three groups for instruction in reading and mathematics. These groups are Primary I, which would be traditionally kindergarten, first, and second grade; Primary II, the third and fourth grades; and Intermediate, the fifth and sixth grades. This procedure is followed to provide the best utilization of staff, clerical assistance, and materials. Such arrangement of classes at Oakleaf has permitted concentration of professional and non-professional help in any of the IPI reading or mathematics sections. This does not mean that other arrangements might work just as satisfactorily. Variations would necessarily need to be made when organizing the school that has more than one grade of students. For example, in schools that have two or three first grade classes and two or three second grade classes, a different strategy might be far more efficient.

Oakleaf School presently has nine teachers and six clerks or teacher aides assigned to the project. Seven teachers are assigned to homerooms and are responsible for the teaching of non-IPI subjects, i.e., subjects other than mathematics, reading, and science. The seven teachers also serve as a nucleus for the program in IPI. They are supplemented by a science-math teacher who is responsible for all the IPI science as well as selected assignments in the mathematics program and a librarian who functions as a reading teacher or consultant for each of the three groupings of students. Math and reading are scheduled one hour each day for the three groupings. In order to share the additional teachers and schedule teacher-aides efficiently, these subjects are never scheduled in competition with each other.

Following is a sample schedule of the Oakleaf School. Notice that scheduling of reading and mathematics for each grouping do not conflict. The schedule only indicates the time and subject for IPI classes and special subjects. Homeroom teachers complete the schedule by adding non-IPI subjects, such as social studies, spelling, writing, health, etc. Both district and school specialists are included on the schedule. This pinpoints free time for classroom teachers. This time is used for planning and evaluating the program of studies.

OAKLEAF ELEMENTARY SCHOOL

CLASS SCHEDULE

Monday

TIME	PRIMARY ONE	PRIMARY TWO	INTERMEDIATE
9:20 - 10:10	READING		(Planning Time) (5) Library (Dist.) (6) P.E. (Dist.)
10:10 - 11:00	(Planning Time) (1) P.E. (Dist.) (2) Library (Dist.)	READING	
11:10 - 12:00		(Planning Time) (3) Library (Dist.) (4) P.E. (Dist.)	READING
12:10 - 1:10	LUNCH	LUNCH	LUNCH
1:10 - 2:00	MATH		(Planning Time) (5) P.E. (Dist.) (6) Library (Dist.)
2:10 - 3:00	(Planning Time) (1) Library (Dist.) (2) P.E. (Dist.)	MATH	
3:10 - 4:00		(Planning Time) (3) P.E. (Dist.) (4) Library (Dist.)	MATH

OAKLEAF ELEMENTARY SCHOOL

CLASS SCHEDULE

Tuesday

TIME	PRIMARY ONE	PRIMARY TWO		INTERMEDIATE	
9:20 - 10:10	READING			(Planning Time) (5) Science 9:20-10:05	(6) P.E. 9:20-10:05
10:10 - 11:00		READING		(5) P.E. 10:10-10:55	(6) Science 10:10-10:55
11:10 - 12:00		(Planning Time) (3A) Science (3A) P. E.	(3B) P. E. (3B) Science	READING	
12:10 - 1:10	LUNCH	LUNCH		LUNCH	
1:10 - 2:00	MATH		(4) P. E. 1:15-1:55		
2:10 - 3:00		MATH			
3:10 - 4:00			(Planning Time) (4) Science	MATH	

OAKLEAF ELEMENTARY SCHOOL

CLASS SCHEDULE

Wednesday

TIME	PRIMARY ONE	PRIMARY TWO	INTERMEDIATE
9:20 - 10:20	(Planning Time) (1A) SCI. | (1B) St. T. (1A) St. T | (1B) SCI. (2) Music	READING	
10:20 - 11:10	READING	(Planning Time) (3) P.E. (4) Music (Dist.)	
11:10 - 12:00	(Planning Time) (2A) SCI. | (2B) St. T. (2A) St. T. | (2B) SCI.		READING
12:10 - 1:10	LUNCH	LUNCH	LUNCH
1:10 - 2:00		(Planning Time) (3) Music (Dist.) (4) P. E. (Dist.)	MATH
2:10 - 3:00	MATH		(Planning Time) (5) P. E. (Dist.) (6) Music (Dist.)
3:10 - 4:00		MATH	(5) Music (Dist.) (6) P.E. (Dist.)

OAKLEAF ELEMENTARY SCHOOL

CLASS SCHEDULE

Thursday

TIME	PRIMARY ONE		PRIMARY TWO		INTERMEDIATE	
9:20 - 10:10	READING			(4) P.E. 9:20-10:00	(Planning Time) (5) Science 9:20-10:05	(6) P.E.
10:10 - 11:00			READING		(5) P.E. 10:10-10:55	(Planning Time) (6) Science 10:10-10:55
11:10 - 12:00	(1) P.E. 11:30-12:00			(Planning Time) (4) Science 11:15-12:00	READING	
12:10 - 1:10	LUNCH		LUNCH		LUNCH	
1:10 - 2:00	MATH					
2:10 - 3:00		(2) P.E. 2:00-2:30	(Planning Time) (3A) Science (3A) Library	(3B) Library, (3B) Science	MATH	
3:10 - 4:00	(Planning Time) (1) Library 3:00-3:30	(2) Library 3:30-4:00	MATH SEMINAR			(6) P.E. 3:20-4:00

OAKLEAF ELEMENTARY SCHOOL

CLASS SCHEDULE

Friday

TIME	PRIMARY ONE			PRIMARY TWO		INTERMEDIATE	
9:20 - 10:10	(1A) SCI. (1A)St. T.	(Planning Time) (1B)St. T. (1B) SCI.	(2) Art (Dist.)	READING		(5) P. E. 9:10-9:40	(6) P. E. 9:40-10:10
10:10 - 11:00	READING			(Planning Time) (3) P. E. (C. C.)	(4) Art (Dist.)		
11:10 - 12:00	(Planning Time) (1) Art (Dist.)	(2A)SCI. (2A)St. T.	(2B)St. T. (2B)SCI.			READING	
12:10 - 1:10	LUNCH			LUNCH		LUNCH	
1:10 - 2:00	MATH				(4) P. E. 1:30-2:00	(Planning Time) (5) Music (Dist.)	(6) Art (Dist.)
2:10 - 3:00				MATH		(5) Art (Dist.)	(6) Music (Dist.)
3:10 - 4:00	(1) P.E. 3:00-3:30	(2) P.E. 3:30-4:00		(Planning Time) (3) Art (Dist.)	(4) Music (Dist.)	MATH SEMINAR	

Improving the quality of the classroom teaching is a prerequisite of all modern schools. Providing special in-service programming for teachers to develop a program of individualization is indeed a serious matter for the administrator. Plans must be made early to employ teachers longer than the typical school year. Summer months provide an excellent opportunity for a continuous program of in-service education. As one begins such a project, the first summer will be needed to permit teachers to first write objectives in behavioral terms for the curriculum area that is to be individualized. This implies defining units of work within the curriculum, leveling and sequencing each behavioral statement. This might be done in a variety of patterns; for example, teams of teachers may concentrate on an area, i.e., reading, mathematics. Other patterns might be primary teachers with primary objectives and intermediate teachers with intermediate objectives or smaller groups of staff members being concerned with one unit -- example, addition, all levels. Regardless of the format used, staff communication is essential. All teachers must have the opportunity to react and interact with the developers and the total continuum. It behooves the administrator to create an atmosphere of honest, self-criticism, where teachers feel free to suggest other alternatives.

Once agreement is reached concerning the objectives of the curriculum, the problems of providing materials to teach each objective and developing diagnostic instruments exist. Chapter II of this manual has some suggestions for each of these areas.

Summer sessions should include the development of strategies for prescription writing, housing of materials, and practice runs. It is important that teachers feel secure with this approach to teaching elementary school subjects.

Structured planning sessions should be viewed as a continuation of in-service programs for teachers. The sample schedule of Oakleaf School indicates that most teachers have about seven hours of planning time per week. This time is used in two ways: First, half the time is devoted to the specific purpose of reviewing the growth of each child along the learning continuum, developing immediate strategies and alternatives for special problems, and reviewing the success of the teaching materials. This careful analysis of the growth of each child insures adequate provisions are being made to provide for individual differences. Secondly, schedule planning time is needed to permit teachers to write prescriptions for each student. Therefore, half of the schedule planning time is used in this manner.

Once a strategy has been agreed upon within a planning session, all teachers should adhere to this strategy until the group determines a change. This is important to provide for the administrator some stable criteria and basis for evaluation. One aspect of IPI that differs from non-IPI is that through structured planning sessions teachers are provided with an opportunity to continuously evaluate materials. It is not unusual in the IPI program to have a teacher complain that Johnny is not learning C subtraction and suggest that the materials are at fault. It is unusual for a teacher in a non-IPI situation to complain that her lesson plan was poor and not effective for Johnny.

Teachers of special subjects such as art, music, physical education, etc. are important ingredients within any school. This certainly is true of IPI programs. Scheduling and using these special teachers can help provide a means to free the classroom teacher of teaching responsibilities. Planning sessions can be provided during the day using this technique. Many schools feel that the classroom teacher should be in the classroom when the specialist is teaching, their reasoning being that the classroom teacher should carry on what the specialist has begun. This philosophy will have to be altered until some other method of releasing the classroom teacher from this responsibility is found. It is important that the administrator provide as much communication as possible with specialists to create good will among all faculty members. Specialists should be aware of the results of planning sessions and understand the function of the classroom teacher during this time. Care must be taken so that special subjects are not of secondary importance in the minds of regular teachers.

Collection of data and keeping of accurate records is one aspect of the individualized program that grows in importance. To adequately prepare prescriptions for students mandates carefully kept records. If possible, a data collection specialist should be part of the staff.

The following charts are used at Oakleaf School to record data for each student. The Arithmetic Placement Chart is used to record the scores from Placement Tests for twelve areas of mathematics. Scores taken from either the lower or upper level placement tests are summarized on the Arithmetic Placement Chart. Space is provided for both the number and per cent of right answers from level B through H. Notice that an "X" appears on the chart for certain levels and areas. This is an indication that there are no objectives in the continuum for this level and area.

NAME ____________________ NUMBER __________

CLASS __________

ARITHMETIC PLACEMENT SCORE PROFILE

	Lower Level								Upper Level							
			B	C	D	E	Tot	Begin Unit			E	F	G	H	Tot.	Begin Unit
1. Numeration	Date	Score	30	10	10	10	60		Date	Score	10	10	10	25	55	
		Points								Points						
		%								%						
2. Place Value	Date	Score	X	10	10	10	30		Date	Score	10	10	X	6	26	
		Points	X							Points			X			
		%	X							%			X			
3. Addition	Date	Score	20	25	25	20	90		Date	Score	20	10	20	10	60	
		Points								Points						
		%								%						
4. Subtraction	Date	Score	X	20	18	10	48		Date	Score	10	10	10	10	40	
		Points	X							Points						
		%	X							%						
5. Multiplication	Date	Score	X	X	25	30	55		Date	Score	30	25	10	10	75	
		Points	X	X						Points						
		%	X	X						%						
6. Division	Date	Score	X	X	20	25	45		Date	Score	25	10	10	15	60	
		Points	X	X						Points						
		%	X	X						%						
7. Combination of Processes	Date	Score	X	20	20	20	60		Date	Score	20	10	10	10	50	
		Points	X							Points						
		%	X							%						
8. Fractions	Date	Score	10	10	12	20	52		Date	Score	20	40	20	10	90	
		Points								Points						
		%								%						
9. Money	Date	Score	10	10	15	10	45		Date	Score	10	10	X	X	20	
		Points								Points			X	X		
		%								%			X	X		
10. Time	Date	Score	10	10	10	6	36		Date	Score	6	10	X	X	16	
		Points								Points			X	X		
		%								%			X	X		
11. Systems of Measurement	Date	Score	10	6	10	10	36		Date	Score	10	10	X	X	20	
		Points								Points			X	X		
		%								%			X	X		
12. Geometry	Date	Score	10	10	10	10	40		Date	Score	10	20	15	10	55	
		Points								Points						
		%								%						

The following calendar lists the school days from September through June. A calendar is kept for each student in the IPI subjects. This is used to indicate unit and number of days each student is working in the unit. Absence, field trips, etc. are deducted. This calendar provides a day-by-day accounting of where each student is in each IPI area. Not only are the days of the month listed, but also the school days for the entire year.

Na ____________ ____ . ________ Class ________ Student Nr ________

STUDENT CALENDAR

2-30 SEPT. 1-20	2	3	7	8	9	10	13	14	15	16	17	20	21	22	23	24	27	28	29	30			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
1-29 -OCT. 21-40	1	4	5	6	7	11	12	13	14	15	18	19	20	21	22	25	26	27	28	29			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
1-30 -NOV. 41-60	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	29	30			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60			
1-23 -DEC. 61-77	1	2	3	6	7	8	9	10	13	14	15	16	17	20	21	22	23						
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77						
3-31 JAN. 78-97	3	4	5	6	7	10	11	12	13	14	17	18	19	20	24	25	26	27	28	31			
	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97			
1-28 FEB. 98-117	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28			
	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117			
1-31 MARCH 118-140	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	31
	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
1-29 APRIL 141-158	1	4	5	6	12	13	14	15	18	19	20	21	22	25	26	27	28	29					
	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158					
2-31 MAY 159-179	2	3	4	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	31		
	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179		
1-9 JUNE 180-186	1	2	3	6	7	8	9																
	180	181	182	183	184	185	186																

Pre-test and post-test information is recorded for each student for the thirteen areas of the mathematics continuum on the _Unit Summary Chart_. Space is provided for more than one pre-test and post-test score. At the bottom of the chart is an order section. This permits data to be recorded in the order of units worked by a student. Recorded on the _Unit Summary Chart_ is information concerning the percentage, dates, number of days involved, and the number of pages each student has completed.

Unit	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
		Pre		Post					Pre		Post					Pre		Post					Pre		Post				
		1	2	1	2	3	4		1	2	1	2	3	4		1	2	1	2	3	4		1	2	1	2	3	4	
7. Combination of Processes	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
8. Fractions	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
9. Money	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
10. Time	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
11. Systems of Measurement	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
12. Geometry	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
13. Special Topics	Level		Order					Tot		Order					Tot		Order					Tot		Order					Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												

ARITHMETIC UNIT CHART - cont'd.

Student Number ______________ Class ________

Unit Test Summary - Arithmetic

Unit	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
		Pre		Post					Pre		Post					Pre		Post					Pre		Post				
		1	2	1	2	3	4		1	2	1	2	3	4		1	2	1	2	3	4		1	2	1	2	3	4	
1. Numeration	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
2. Place Value	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
3. Addition	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
4. Subtraction	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
5. Multiplication	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												
6. Division	Level	Order						Tot	Order						Tot	Order						Tot	Order						Tot
	Score																												
	%																												
	Date																												
	Days																												
	Pages																												

Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

ARITHMETIC UNIT CHART

The Arithmetic and Reading Unit Test Record is for recording pre- and post-test scores for mathematics and reading for each student. Both charts can be found in each student's prescription folder. This enables the teacher to see quickly the tests taken in reading and the results.

Name ____________________ Class ____________

Unit Test Record - Arithmetic

8. Fractions		Level						Level						Level						Level					
		1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post			
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								
9. Money		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								
10. Time		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								
11. Systems of Measurement		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								
12. Geometry		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								
13. Special Topics		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
	Date																								

Name ____________________

Class ________

Unit Test Record - Arithmetic

		Level						Level						Level						Level					
		1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post			
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
1. Numeration	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
2. Place Value	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
3. Addition	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
4. Subtraction	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
5. Multiplication	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
6. Division	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
7. Combination	Score																								
of	%																								
Processes	Date																								

Name ______________________ Unit Test Record - .ding Class_____ ___

READING UNIT TEST RECORD

		Level						Level						Level						Level					
		1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post				1-Pre-2		Post			
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
1. Critical Reading	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
2. Figurative Language	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
3. Organizational Skills	%																								
	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
4. Phonetic Analysis	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
5. Structural Analysis	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
6. Extra Wordal Symbols	%																								
	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
	Score																								
	%																								
7. Locational Skills	Date																								
		Level						Level						Level						Level					
	Total			1	2	3	4			1	2	3	4			1	2	3	[illegible]			1	2	3	4
	Score																								
	%																								
8. Rate of Reading	Date																								

The Beginning Reading Record is used to record beginning reading information from the McGraw-Hill Series and the reading continuum. This chart includes a section for level E of the reading continuum, labeled "Unit Test Summary." Notice that the score, date, days in a unit, and number of pages completed are recorded. Again, the order in which the material is completed is indicated on this chart.

Name ______________________________ Student Number ______________ Class __________

McGraw-Hill Series - Books 1-14

Ls.	P	1	☒	2	☒	3	☒	4	☒	5	☒	6	☒	7	☒	8	☒	9	☒	10	☒	11	☒	12	☒	13	☒	14	☒
1		13		12		10		11		5		8		16		17		18		30		25		27		12		38	
2	R	8		14		13		12		9		9		5		14		13		32		10		12		35		21	
3		12		10		14		5		8		10		10		9		26		26		19		23		10		26	
4	I	12		13		24		9		13		8		13		30		26		39		27		31		31		28	
5		7		8		13		9		12		9		18		20		16				32							
6	M	10		9		14		14		8		10		17		15		16											
7		13		14						12		11		9															
8	E	4		7								18																	
Mid		26		32		51		28		31		52		54		59		39		52		82		72		95		114	
End	R	50		50		50		50		50		50		50		50		50		50		50		50		50		50	
Final														94														100	
Days																													

Unit Test Summary - Reading

Unit	Level		Order				Tot	
		Pre		Post				
		1	2	1	2	3	4	
Critical Reader	Score							
	%							
	Date							
	Days							
	Pages							
	Level		Order				Tot	
Explaining Relationships	Score							
	%							
	Date							
	Days							
	Pages							
	Level		Order				Tot	
Figurative Language	Score							
	%							
	Date							
	Days							
	Pages							
	Level		Order				Tot	
Locational Skills	Score							
	%							
	Date							
	Days							
	Pages							

	Level		Order				Tot
		Pre		Post			
		1	2	1	2	3	4
5. Phonetic Analysis	Score						
	%						
	Date						
	Days						
	Pages						
	Level		Order				Tot
6. Word Analysis	Score						
	%						
	Date						
	Days						
	Pages						
	Level		Order				Tot
7. Auditory Discrimination	Score						
	%						
	Date						
	Days						
	Pages						
	Level		Order				Tot
8. Oral Reading	Score						
	%						
	Date						
	Days						
	Pages						

Order	1	2	3	4	5	6	7	8

The Unit Test Summary, Reading, is a sample of the form used to record summary data in reading. When students are working in levels A, B, C, or D, this chart is used. Again note the ordering table at the bottom of the page. This is used to provide proper sequence for each student.

Name ______________________ Student Number ______________ Class ________

Unit Test Summary - Reading

	Level		Order					Tot		Order					Tot		Order					Tot
		Pre		Post					Pre		Post					Pre		Post				
		1	2	1	2	3	4		1	2	1	2	3	4		1	2	1	2	3	4	
Critical Reading	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Figurative Language	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Organi-zational Skills	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Phonetic Analysis	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Structural Analysis	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Extra Wordal Symbols	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Locational Skills	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					
Rate of Reading	Level		Order					Tot		Order					Tot		Order					Tot
	Score																					
	%																					
	Date																					
	Days																					
	Pages																					

Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Two samples of student prescription blanks follow. Note detail information on the front and back of each blank. The prescription blank varies from level to level in the reading and mathematics program.

The front of the prescription blank lists necessary information, such as level, unit, pre-test scores, post-test scores, and also provides space for specific teacher assignments.

The back of the prescription sheet presents a breakdown of the test in the specific unit and skill areas. This, then, enables the teacher to prescribe in the skill area of weakness. This information recorded on the back is convenient for teacher use.

MATHEMATICS PRESCRIPTION SHEET

Name ________________________________ Class __________ Page ______

Level ________ Unit ____

Begin	
End	
Days Worked	

Unit Tests

	Pre		Post		
	1	2	1	2	3
Score					
%					
Date					

	Worksheets								Curriculum Test			
									Part 1		Part 2	
	Date Pres.	Pres. Init.	Page No.	Skill No.	Items	Score	Date	Sc's Init.	Items	%	Items	%
1												
5												
10												
15												
20												
25												
30												

LEVEL F MATHEMATICS PRESCRIPTION SHEET - cont'd.

	T	Pgs	Pgs	Pgs	Pgs	Skill	Pts	Pre	%	Post	%	Post	%	Post	%	Post	%
Fractions						1	10										
						2	10										
						3,5	10										
						4	10										
						6,7	10										
						8,9	10										
						10	10										
						11	10										
						12a,b	10										
						Total	90										
	T	4	3	2	1	%											
						Date											
						Time											
Money						1	10										
						Total	10										
	T	4	3	2	1	%											
						Date											
						Time											
Time						1	10										
						2	10										
						3	10										
						4,5a	6										
						4,5b	4										
						Total	40										
	T	4	3	2	1	%											
						Date											
						Time											
Systems of Measurement						1,2	10										
						Total	10										
	T	4	3	2	1	%											
						Date											
						Time											
Geometry						1	10										
						2	10										
						3	10										
						4	10										
						5	10										
						6,7,9	10										
						8	10										
						Total											
	T	4	3	2	1	%											
						Date											
						Time											
Special Topics						1	10										
						2	10										
						3	10										
						4	10										
						5a	6										
						5b	4										
						Total	50										
	T	4	3	2	1	%											
						Date											
						Time											

READING PRESCRIPTION SHEET

Name ____________________ Class ________ Page ________

Level ________ Unit ____________________

Begin	
End	
Days Worked	

Unit Tests

	Pre		Post			
	1	2	1	2	3	4
Score						
%						
Date						

	Worksheets								Curriculum Test				
	Date Pres.	Pres. Init.	Page No.	Skill No.	Items	Score	Date	Sc's Init.	Part 1		Part 2		Sc's Init.
									Items	%	Items	%	
1													
5													
10													
15													
20													
25													
30													

READING PRESCRIPTION SHEET - cont'd.

LEVEL F

Critical Reading

T	Pgs	Pgs	Pgs	Pgs	Skill	Pts	Pre	°/°	Post	°/°	Post	°/°	Post	°/°	Post	°/°
					1a,b	5										
					2a,b	5										
					3	5										
					4,5	10										
					6	2										
					7,8	16										
					9,11	7										
					10	5										
					12	1										
					Total	56										
T	4	3	2	1	°/°											
					Date											
					Time											

Figurative Language

					1abo	10										
					2	10										
					Total	25										
T	4	3	2	1	°/°											
					Date											
					Time											

Organizational Skills

					1a	5										
					1c	4										
					2a	8										
					2b	12										
					3a,b	3										
					4	5										
					5a	8										
					5b	1										
					Total	46										
T	4	3	2	1	°/°											
					Date											
					Time											

Phonetic Analysis

					1	15										
					2	10										
					3,7	10										
					4,6	12										
					5	10										
					6	12										
					89,10	10										
					11	10										
					Total	89										
T	4	3	2	1	°/°											
					Date											
					Time											

Teacher aides are an important aspect of the Oakleaf project. Scoring the student material used in the IPI project and freeing teachers of this duty provides more time to teach. Keeping of day-to-day records and providing feedback information to teachers are among the most important functions of teacher aides.

The following is a suggested job description for teacher aides in an individualized program. Mr. Jack Fisher, Research Assistant from the Learning Research and Development Center, who has supervised the collection of data and the functions of teacher aides in the Oakleaf project, submits the following teacher aide functions. He points out that the function of the aides can be classified generally as work involved directly with the classroom, work done supplemental to the classroom, and duties dictated by the nature of the individualized project and the relevant data which the Learning Research and Development Center is interested in obtaining. By categories, these functions are:

I. Classroom Functions

   A. Kindergarten

      1. Preparation of pre-primer reading materials
      2. Scoring and recording the student work pages found in kindergarten book 1-14
      3. Preparing and duplicating work and practice sheets

   B. Grades 1-2-3

      1. Scoring and recording all placement tests
      2. Scoring and recording all unit tests, making breakdowns of the test by skills, prescription sheets
      3. Scoring and recording all student worksheets
      4. Obtaining and placing all worksheets in student folders

5. Sound discs -- locating for pupils, assisting with the sound discs and machines

    a. Scoring and recording all work pages supplemental to the sound discs

6. Scoring, recording books and tests of the McGraw Hill Series (Books 1-14)

    a. Listening to and recording oral tests

7. Replacing, duplicating continuum materials

C. Grade 3

1. Same as above, with the exception that the students are not in McGraw Hill Books

D. Grades 3-4-5-6

1. Scoring, recording all placement tests

2. Scoring, recording all unit tests, making breakdowns of the test by skills, preparing prescription sheets

3. Scoring and recording all student worksheets in Grades 3-4

4. Assisting, but not filling, student prescriptions

5. Scoring and recording all curriculum embedded tests (Grades 5-6)

    a. Students score own worksheets in Grades 5-6

E. Science Program -- Grades 1-2-3

1. Scoring, recording all tests -- written and oral

2. Preparing lesson kits, materials, tapes

II. Functions Supplemental to the Classroom -- All Grades

A. Keys and Prescription Folders

1. Making keys for teachers

B. Work Pages -- Continuum

1. Numbering pages in proper sequence, inventory,

ordering pages, putting them in carts, duplicating work pages

C. Weekly Reports

  1. Current status of work within the units

    a. Used in teacher conferences

    b. Prepare reports for the Learning Research and Development Center

C. Filing Work

  1. All tests numbered in order taken and filed in each student's test file

  2. Compared student's prescription sheets placed in student's binder

III. Data Work Relevant to the Study

A. Recording all Tests, Pages, and Days Worked

  1. Summary data

    a. Tests taken, socres, skills worked, pages done in the skills, days worked, order the unit was worked

      (1) Recorded for card punching purposes on an IBM layout

  2. Preparing specific data reports requested

    a. Weekly report for Learning Research and Development Center on number of tests taken, scores

      (1) All grades, all units

    b. Reports to the Learning Research and Development Center on any pertinent information they may request

B. Inventory and ordering of materials from the Center

  1. Tests and work pages

C. Preparing materials for dissemination purposes to other schools

D. Scoring, Recording, Graphing

1. Achievement tests
2. I.Q. tests

The administrator must accept the responsibility of storing the variety of materials needed to teach each objective. Strategies must be developed to permit the student to either find his own materials or establish a system through which materials are given to each student. No matter how good a specific piece of material is in teaching an objective, if it is not available to the student, it serves no purpose at all. Therefore, the flow of materials from the developers to its place of storage and to each individual student is a momentous task.

Scheduling of non-classroom activities of teachers in an efficient manner is an important function of the administrator. Planning for pupils is necessary because of the diversification of the learning process. Time must be available for discussing individual student problems with teachers, writing prescriptions, analyzing materials and tests, and planning teaching strategies.

During planning sessions, the administrator serves as a consultant and an advisor. He discusses problems, offers advice, and receives feedback on materials and procedures. In this setting, he and the staff work together to achieve mutual goals.

Parent interest must be satisfied. The interest in innovative activities of the school will increase. Consequently, the administrator must keep parents well informed, and innovative techniques must be explained carefully. The administrator must provide leadership, direction, organization, and management of all aspects of an individualized program.

CHAPTER VI

Research Related to IPI

The Learning Research and Development Center is continuously conducting research associated with the project on Individually Prescribed Instruction. A supplemental package of research papers that have been prepared by LRDC is included as part of this manual. These papers include:

1. Variability of Pupil Achievement in Mathematics -- John O. Bolvin

2. Transfer and Generalization in Individually Prescribed Instruction -- Joseph I. Lipson

3. A Comparison of Item Selection Technique for Norm-Referenced and Criterion-Referenced Tests -- Richard Cox and Julie Vargas

4. The Development of a Sequentially Scaled Achievement Test -- Richard Cox and Glenn Graham

5. Concept Development in the Elementary School Science Curriculum -- Joseph I. Lipson

6. Placement and Progress for Individually Prescribed Instruction -- John O. Bolvin

7. An Exploratory Investigation of Selected Measures of Rate of Learning -- John Yeager and C. M. Lindvall

8. The Effect of an Individually Prescribed Instruction Program in Arithmetic on Pupils at Different Ability Levels -- Donald Deep

CHAPTER VII

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The Essential Elements of IPI

C. M. Lindvall

Individually Prescribed Instruction represents a specific procedure for planning and carrying out classroom instruction. It is not tied to any set lesson content and can, presumably, be used with a great variety of subject matter. However, as an instructional procedure it is characterized by certain elements in its plan and practices which serve to differentiate it from other educational procedures. It is the purpose of this paper to spell out the details of these specific elements. This listing, then, serves to define Individually Prescribed Instruction. Any school adopting this type of instruction can use this as a checklist to determine whether or not it actually has an IPI porgram and to identify and describe any departures from the basic plan.

I. IPI must be based on a carefully sequenced and detailed listing of behaviorally stated instructional objectives. Such listings must be used in planning most other aspects of the program and should have the following characteristics.

1. Each objective should tell exactly what a pupil should be able to do to exhibit his mastery of the given content and skill. This should typically be something that the average student can master in a relatively short time such as one class period. Objectives should involve such action verbs as solve, state, explain, list, describe, etc. rather than

*ALSO INCLUDE VAST
[illegible]

such general terms as understand, appreciate, know, and comprehend.

2. Objectives should be grouped in meaningful streams of content. For example, in arithmetic the objectives will typically be grouped into such areas as numeration, place value, addition, subtraction, etc. Such grouping aids in the meaningful development of instructional materials and in the diagnosis of pupil achievement. At the same time, this grouping does not preclude the possibility of having objectives that cut across areas.
3. Within each stream or area the objectives should, to the extent possible, be sequenced in an order such that each one builds on those that precede it and is prerequisite to those that follow. The goal here is to let the objectives constitute a "scale" of abilities.
4. Within the sequence of objectives in each area the objectives should be grouped into meaningful sub-sequences or units. Such units can be designated as representing different levels in progress and provide break-points such that when a student finishes a unit in one area, he may either go on to the next unit in that area or may switch to a unit in another area. (For example, upon completing Level B Addition the pupil may go on to Level C Addition or may move to Level B Subtraction.)

II. IPI lesson materials must be geared exactly to the instructional objectives and must be such as to permit pupils to proceed quite independently with a miminum of direct teacher instruction.

1. Each piece of lesson material and each learning exercise must be identified as teaching some specific objective in the sequence and must be marked or coded in terms of that objective. The material should be such that when the pupil has completed his work with it there is a high probability that he will be able to pass a test covering the objectives.
2. Most lesson material should be such that the pupil can work with it with little or not teacher assistance. This can involve the use of such things as workbook pages, programmed materials, recorded lessons and instructions, and materials with which one student works with another. It does not preclude the occasional use of lessons that require explanations by the teacher but does mean the essential elimination of lecture-type presentations. The procedure must be such that teacher time can be reserved for work with individual pupils.
3. Lesson materials must be subject to continuous scrutiny and analysis on the basis of pupil performance. Procedures should be established whereby lessons that are not effective are identified and modified or replaced. A definite part of the IPI procedure is specific provision for revision on the basis of feedback regarding pupil performance.
4. Lesson materials used in IPI must be such that they require the pupil to actually perform and practice the skill that he is to acquire. That is, these materials cannot be of the type that merely requires the pupil to "read about" the things he

is to master. For example, in a science unit on magnetism in which the pupil is to learn how to distinguish whether a material is magnetic or not, the lesson material must give him practice in carrying out this step rather than merely requiring that he read an explanation of it.

5. IPI lesson materials must be developed as a total "package" covering the entire curriculum sequence and should be available in completed form before the program is inaugurated. IPI is an organized instructional procedure in which all details of instruction are part of an integrated plan. Lesson materials should not be left for development "when and if needed." An insistence on this pre-planning of the total lesson sequence is not intended to inhibit the introduction of modifications or innovations when these seem desirable. Rather, its intent is to provide a basic structure which can be used as is or can be modified in an organized and logical manner.

6. Lesson materials must be prepared in a form which facilitates the preparation of individualized sequences for each pupil. In the present early version of IPI this has been achieved through the extensive use of individual loose lesson pages which can be arranged in whatever order is desired. Although such sheets may be superceded by other types of materials, the goal must be to retain this type of flexibility.

III. A basic aspect of the IPI procedure is rather detailed provision for diagnosis of pupil skills and abilities and continuous monitoring of pupil progress.

1. There must be specific provision for the use of tests and other information to place pupils at the proper point to begin work in each of the curriculum sequences. These placement tests must be criterion-referenced so that they provide rather exact information concerning what objectives a pupil has and has not mastered. With the presently used IPI placement tests information is obtained which provides for the correct placement of the pupil at the proper level in each content area. (C Numeration, B Place Value, B Addition, etc.)
2. There must be provision for pre-testing of the student before he begins each unit of work. This provides exact information concerning his command of any material in the unit and serves as a basis for developing his prescription describing what materials he needs to study. Prescription writing may be based on a variety of types of information concerning the student, but the basis data are those that describe his achievement.
3. There must be provision for a continuous monitoring of pupil progress as the student works through his sequence of exercises within a unit. Some of this monitoring can be accomplished by observing his work and scoring his worksheets and other exercises. However, Individually Prescribed Instruction requires additional and more objective data based on Curriculum Embedded Tests. These are tests, resembling worksheets

in general format, that the pupil takes when he completes his study of each objective. A curriculum embedded test contains items covering the objective in question and a few additional items covering the next objective. These tests are basic instruments for use in determining when a pupil is ready to move on to a new objective or, perhaps, if he is able to skip a next objective. As such, these tests are essential for preparing prescriptions and, hence, basic to the IPI procedure.

4. As would be anticipated, IPI also requires that unit posttests be given when a pupil has completed work in a unit. This provides an overall survey of his command of the unit and is the basis for deciding whether he needs more work in it or is ready to move on to a new unit.

IV. Perhaps the most unique feature of Individually Prescribed Instruction is its requirement that each pupil's work be guided by written prescriptions prepared to meet his needs and interests.

1. All prescriptions must be developed on the basis of an examination of the individual pupil's record. They must not be developed on any group basis or through the routine assignment of a standard prescription.
2. Prescriptions should cover a relatively small amount of work, such as one objective, and should be developed quite frequently. Confining any prescription to a relatively small segment of work means that the student's lessons will be adjusted frequently to meet his needs.

3. Prescriptions must be quite specific in terms of the exact material that the pupil is to study. A prescription is a detailed, specific, and individualized lesson plan. It is not merely a general description of what the pupil needs to master.

V. As is true with most types of classroom instruction, the work of the teacher is a key aspect of IPI. Some of the essential aspects of teacher performance are the following.

1. Little, if any, time is spent in lecturing to a class or in conducting a large-group discussion. In most cases treating the class as a group is antithetical to the individualization of instruction.
2. Much of a teacher's time is spent in examining the individual pupil's record, in diagnosing his needs, and preparing individual lesson plans (developing prescriptions). The teacher's role in preparing for instruction is not one of deciding what he is going to teach and how he is going to present it but is rather that of determining what each pupil needs and arranging for the necessary learning experiences.
3. The teacher will spend considerable class time in helping individual pupils. That is, the teacher will spend little time standing in front of the class but, for the most part, will be moving about from pupil to pupil answering individual questions and providing necessary explanations.
4. The teacher must be a responsible evaluator of the effectiveness of lesson materials and learning experiences. If IPI

is to function successfully, the teacher must be alert to pupil difficulties with lesson materials and must analyze such problems not in terms of the inadequacies of the pupils but in terms of what can be done to revise lessons and procedures so as to eliminate such difficulties. The teacher must function as an educational "engineer."

5. If IPI is to be used effectively, provision must be made for frequent and regular staff conferences to discuss individual pupils, to evaluate and adapt materials and procedures, and to make future plans. Such conferences are an essential aid to the development of instructional plans that are really sensitive to the needs of individual pupils. They are also basic to the operation of an instructional technology in which instructional procedures are modified on the basis of pupil performance.

VI. The success of any type of educational curriculum will rest ultimately on the quality of the expereinces that the pupils have. Individually Prescribed Instruction is pupil oriented instruction and differs from other procedures in terms of the types of activities in which pupils are engaged.

1. For the most part, pupils will be working individually and independently. IPI may involve occasional small group and large group instruction, but for the majority of the time each pupil will be working by himself on lesson material that is different from that with which others are working.
2. Much of each student's studying involves active and overt

responding on his part. To a greater degree than in most other types of classrooms pupil study will involve writing answers, solving problems, performing experiments, and other types of overt activity. IPI instruction may involve considerable independent reading by pupils and there will be many occasions when class time will be spent in merely reading. However, whenever possible pupil study demands that pupils actually do things in order to practice the ability that they are expected to acquire.

3. IPI instruction requires that pupils be quite self-dependent and that, within the limits of the general procedure, they make many decisions and plan activities on their own initiative. In more conventional instruction the pupils are as a class, told such things as, "We will now work this page," and "Do not go beyond this page until I tell you to." Under IPI a pupil works from one page to the next at his own pace and determines for himself when he has completed an assignment and when his work is ready to be checked. Pupils work under conditions in which they are responsible for their own rate of learning and eventually come to realize that learning is a process that is dependent on their participation and initiative.

4. Each pupil must be getting regular and frequent feedback concerning the effectiveness of the work he is doing and the progress he is making. The IPI process must provide for getting information to the student concerning his success

on every lesson exercise. This may take the form of letting the pupil check his own papers with some type of key or having them checked by teachers or teacher aides. In any event the pupil should be getting rather immediate information concerning his success with lessons or on tests.

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